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AERODYNAMIC AND AEROTHERMODYNAMIC
STUDIES ON THE HASP 1.0-INCH
DIAMETER DART

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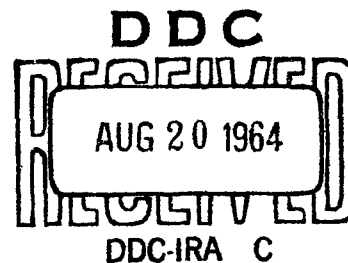
Aerodynamics Research Report 208

AERODYNAMIC AND AEROTHERMODYNAMIC STUDIES
ON THE HASP 1.0-INCH DIAMETER DART

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ABSTRACT: The High Altitude Sounding Projectile, HASP, has
been the subject of a design study aimed at enhancing the
round's performance. The techniques used and the results
obtained from this study are described. It was found that by
decreasing the dart's diameter to 1.0-inch and using the
standard MK 32 MOD 0 HASP motor, altitudes of the order of
300,000 feet could be achieved. However, this improved
performance is not attainable simply by scaling down the present
1.375-inch diameter dart. Indeed, the following significant
changes are required; an increased static margin, a decreased
fin-cant angle, use of a fin material whose strength does not
materially deteriorate at elevated temperatures, and thermal
protection for the motor casing.

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AERODYNAMIC AND AEROTHERMODYNAMIC STUDIES
ON THE HASP 1.0-INCH DIAMETER DART

These analyses were performed at the request of the HASP
Project Manager, Mr. M. J. Parker, under Task Numbers
FAME 04001/212 4/F003 02 003 and FAME 04002/212 4/F003 02 003.

The purpose of these studies was two-fold; to determine the
feasibility of attaining a 300,000 foot altitude with a
smaller diameter dart using the standard, MK 32 MOD 0 motor,
and to make recommendations to the HASP Design and Development
Committee, of which the author is a member, regarding the
design and development of such a system.

                              R. E. ODENING
                              Captain, USN
                              Commander

                              K. R. ENKENHUS
                              By direction

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INTRODUCTION

The HASP projectile consists of a dart and rocket motor. Its purpose is to obtain meteorological data on a routine basis from altitudes up to 250,000 feet (ref. (1)). Designed for use aboard ship, HASP does not require special launchers or tracking equipment but can utilize the ship's 5-inch guns and gun director radar.

The object of the design study described in this report was to determine means by which the HASP system, using the present .otor, could be modified to attain an altitude of 300,000 feet. Preliminary trajectory calculations based on realistic weight and drag reductions of the system indicated that the design objective appeared feasible if other anticipated problems associated with aerodynamic stability and heating could be resolved.

Concurrently with the design study there was a prototype dart development and field test. The 1.0-inch diameter, 5-pound prototype for reaching 300,000 feet was built similar to the standard 1.375-inch diameter dart. The resultant configuration is shown in Figure 1. It was necessary to retain the fin-span and tip-chord dimensions of the 1.375-inch dart so that the round would be compatible with the launcher. The root-chord was scaled down. This resulted in a fin with a 60° leading-edge sweep, which was then set at an incidence angle of 30 minutes. The fin material consisted of 0.060-inch thick aluminum plate. Nose cone dimensions were scaled down consistent with the packaging requirements of the fuze. The scaled-down body length was increased somewhat to get additional weight forward to insure the static stability of the dart-booster combination.

Initial firings of the configuration described above have been unsuccessful. The primary difficulty has been the failure to track the dart and it is strongly suspected that the dart is experiencing erratic flight behavior.

This report analyzes the prototype to determine possible causes of malfunction. As a result of the analysis, a number of recommendations are made.

SYMBOLS

A	reference area
AL	quadrant elevation
A(W)	wall surface area being heated
b	fin span
C_d	drag coefficient, F_d/qA
C_L	lift coefficient, F_ℓ/qA
C_{L_α}	lift coefficient slope, $dC_L/d\alpha$
C_m	pitching moment coefficient, m/qA
C_{m_α}	pitching moment coefficient slope, $dC_m/d\alpha$
$C_{m_q} + C_{m_{\dot\alpha}}$	pitch damping coefficient, $dC_m/d(q\ell/2V)+dC_m/d(\dot\alpha\ell/2V)$
$C_{m_{p\beta}}$	Magnus moment coefficient, $d^2C_m/d(p\ell/2V)d\beta$
C_N	normal force coefficient, F_n/qA
C_{N_α}	normal force coefficient slope, $dC_N/d\alpha$
CP_F	Magnus force center of pressure
C(W)	specific heat of wall material
D	outer diameter
D(B)	diameter of bird(dart)
D(M)	diameter of motor
d	body diameter
E(W)	emissivity of wall surface
F_d	drag
F_ℓ	lift force

F_n normal force

F_t thrust

g acceleration of gravity

g_o acceleration of gravity at sea level

H heat transfer coefficient

ISP specific impulse

ISP(0) specific impulse at zero ambient pressure

I_x axial moment of inertia

I_Y transverse moment of inertia

K(T) constant in equation for specific impulse

k thermal conductivity of ambient air

k_a dimensionless axial radius of gyration, $(I_x/M\ell^2)^{\frac{1}{2}}$

k_t dimensionless transverse radius of gyration, $(I_Y/M\ell^2)^{\frac{1}{2}}$

L wall thickness

ℓ reference length

ℓ_E effective body length

M mass

M free-stream Mach number

M(B) mass of bird

M(0) initial mass of rocket(booster plus bird)

M(P) initial mass of propellant

MR mass rate of flow of propellant combustion products

m pitching moment

P ambient pressure

p	roll frequency
p_c	critical roll frequency
Q	heat flux
QE	quadrant elevation
q	dynamic pressure
R	density of wall material
RN	Reynolds number, $\rho VX/\mu$
r	body radius
s	Stefan-Boltzman constant, 0.475×10^{-12}
T	free-stream temperature, °R
T(0)	initial temperature
T(R)	adiabatic wall temperature
T(W)	wall temperature at surface, °R
t	time
t_a	time of apogee
t_b	time of burnout
V	velocity
V(0)	initial velocity
V(W)	volume of wall material being heated
W	weight
$\dot{W}$	flow rate
W(B)	weight of bird
X	distance aft of fin leading edge or nose cone tip
X_b	center of gravity distance from base
x	range

$\dot{x}$	horizontal velocity
$\ddot{x}$	horizontal acceleration
z	altitude
$z(o)$	initial altitude
$\dot{z}$	vertical velocity
$\ddot{z}$	vertical acceleration
α	pitch incidence relative to axes fixed in body
β	sideslip relative to axes fixed in body
δ	fin cant angle
θ	angle of trajectory with horizontal
μ	viscosity of ambient air
ρ	density of air

TRAJECTORIES

Preliminary performance calculations using 1.0-inch darts with weights varying from 4 to 6 pounds have indicated the feasibility of attaining altitudes in the vicinity of 300,000 feet with the standard MK 32 MOD 0 motor. Maximum altitudes obtainable for quadrant elevations of 75 and 80 degrees, as functions of the various dart weights, are indicated in Figure 2. These range from approximately 290,000 feet to 310,000 feet.

Detailed trajectories were computed in support of the range firings. These provided data for the range safety officer as well as for the radar tracking personnel who have found it difficult to track an object so small and moving as fast as the 1.0-inch dart. The method used for computing the HASP trajectories is described as follows. The dart and motor travel together until propellant burnout. At burnout, the dart separates from the motor and continues upward on its own momentum, reaching some maximum altitude. The assumptions are as follows: (1) the forces acting on the dart-booster combination (considered to be a particle) are drag, thrust and gravity; (2) the forces acting on the dart alone are drag and gravity; and, (3) the earth is assumed to be stationary

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and flat. The equations describing the motion are as follows:

motor and dart
$$W\ddot{x}/g = \cos \theta(F_t - F_d) \tag{1}$$
$$W\dot{z}/g = \sin \theta(F_t - F_d) - W \tag{2}$$

dart alone
$$W\ddot{x}/g = -F_d \cos \theta \tag{3}$$
$$W\dot{z}/g = -F_d \sin \theta - W \tag{4}$$

where

$$W = g[M(0) - (MR)t]$$

$$W(B) = gM(B)$$

$$\cos \theta = \dot{x}/\sqrt{\dot{x}^2 + \dot{z}^2}$$

$$\sin \theta = \dot{z}/\sqrt{\dot{x}^2 + \dot{z}^2}$$

$$F_t = \dot{W} \; ISP/(g/g_o)$$

$$F_d = C_d \rho \; D^2 (\dot{x}^2 + \dot{z}^2)/2$$

$$ISP = ISP(0) - K(T)P$$

The ARDC standard atmosphere was specified and the drag coefficient was varied as follows:

$$C_d = 0.430, \; \text{motor and dart}$$

$$C_d = \begin{cases} 0.2749 \text{ for } M \lessgtr 1.0 \\ 0.4522 \text{ for } 1.0 < M \lessgtr 1.5 \\ 0.1942 + 0.5806/M^2 \text{ for } M > 1.5 \end{cases} \text{dart alone}$$

The boundary conditions are as follows: when $t=0$, $x=0$, $\dot{x}=0$, $z=0$, $\dot{z}=0$, $\theta = AL$ and $M=M(0)$; when $t=t_b$, $M=M(0)-M(P)$; when $t<t_b$, $M=M(B)$; when $t=t_a$, $\dot{z}=0$, and $z=z_{max}$.

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The preceding equations have been programmed for and used on the IBM 7090. The results are presented in the form of plotted (Figure 3) as well as tabulated data (Table 1) and appear at the end of this report. Initial conditions are listed at the head of each run. Trajectories were run at quadrant elevations of 75, 80 and 85 degrees for both the lower and upper specific impulses recorded during static tests of a sampling of the production motors (ref. (2)). This established a corridor within which the dart is expected to travel. Data were printed out at 0.1 second intervals during burning, and at 1.0 second intervals thereafter to impact. Burning lasts for 1.9 and 1.86 seconds for the lower and upper specific impulses, respectively.

STATIC STABILITY

While the dart lengths were expected to vary from approximately 30 to 35 calibers from the 4.0 to the 6.0 pound darts, respectively, their centers of gravity would all be located at approximately 50 percent of their lengths. This center of gravity location is approximately the same for the standard 1.375-inch dart which, according to reference (3), possesses a good margin of static stability over the Mach number range of interest. It was concluded, therefore, that the 1.0-inch dart which will maintain the same fin span as the 1.375-inch dart and approximately the same scaled fin area will also possess adequate static stability for all the weights considered.

The problem arose when the dart-booster combinations were considered. Calculations indicated that the 5 and 6 pound darts in combination with the booster will possess only marginal stability in the Mach number region between 3.5 and 4.0. The 4.0 and 4.8 pound darts in combination with the booster will go unstable at approximately Mach 2.5 and 3.1, respectively, (Figure 4). The center of gravity locations for the various dart-booster combinations were computed at launch and burnout, and a straight line variation assumed between the two end points. Center of pressure calculations for the 1.0-inch dart-booster combinations were performed using normal force slopes and center of pressure data for the 1.375-inch dart and dart-booster combination (ref. (3)). This involved subtracting the static stability contribution of the 1.375-inch dart and replacing it with that of the 1.0-inch dart.

Since it was apparent that the dart-booster combinations mentioned above would benefit by an increase in static stability, it was suggested that the following remedies be considered: (1) the addition or adjustment of weight to the forward end of the dart-booster combinations, thereby improving the center of gravity location; (2) reducing the fin area of the dart; and, (3) increasing the fin area of the booster. It was cautioned that in implementing any one or a combination of the above procedures, care must be exercised not to adversely affect other parts of the system.

The HASP Committee decided that the 5 lb. dart would be acceptable for field tests despite the fact that its static stability in combination with the booster was somewhat marginal.

DYNAMIC STABILITY

Dynamic characteristics, including the gyroscopic and dynamic stability factors as well as pitch and roll frequencies, were determined for the dart prototype, which had the 30 minute fin incidence angle of the standard 1.375-inch dart. This was based on the theories of Murphy, Nicolaides, Charters and Mantle (refs. (4), (5), (6) and (7), respectively).

It was discovered that the dart was dynamically unstable, but could be made dynamically stable by simply reducing the fin incidence angle. The dynamic stability criteria for spinning symmetric missiles (ref. (8)) were applied to the prototype dart in the following manner:

First, the damping derivative in pitch is approximated from slender body theory:

$$C_{m_q} + C_{m_{\dot\alpha}} = -2C_{L_\alpha} (x_b/d)^2 = -4350 \tag{5}$$

where

$$C_{L_\alpha} = 6.35/rad \ (\ ref. \ (3))$$

$$x_b = 18.5 \ in \ (center \ of \ gravity \ distance \ from \ base)$$

$$d = 1.0 \ in \ (reference \ length)$$

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Next, the Magnus moment coefficient can be estimated from the following equation:

$$C_{m_{p\beta}} = 8 \left[\frac{\ell_E(CP_F - x_b)}{d^2} \right] = -1755 \qquad (6)$$

where

$CP_F = \ell_E - (9/14)\ell_E$ (ref. (9) suggests that the center of pressure of the Magnus force, CP_F, for turbulent boundary layer is 9/14 of the effective body length, ℓ_E, from the nose)

$\ell_E = 33.18$ in. (according to ref. (9) this can be obtained by replacing the nose section with an effective cylinder which has the same boundary layer at its base that the nose has at its base)

The roll rate is determined from the following equation:

$$p = \frac{3\delta V}{2} \left[\frac{(\frac{b}{2})^2 - r^2}{(\frac{b}{2})^3 - r^3} \right] \frac{1}{2\pi} \qquad (7)$$

At burnout velocity,

$$\delta = 0.00873 \text{ radians}$$
$$V = 5750 \text{ ft/sec}$$
$$b/2 = 0.1407 \text{ ft}$$
$$r = 0.0416 \text{ ft}$$

These values yield a maximum spin rate of

$$p = 80 \text{ cps}$$

Murphy (ref. (4)) suggests that the reciprocal of the gyroscopic stability factor and the dynamic stability factor form a boundary for the region of dynamic stability. This boundary (Figure 5) is described by the equation:

$$4\hat{m}/\hat{p}^2 = S_d(2 - S_d) \qquad (8)$$

The gyroscopic stability factor is defined as:

$$4\hat{m}/\hat{p}^2$$

(9)

where

$$\hat{m} = \frac{\rho A \ell}{2M} \left[\frac{M\ell^2}{I_Y} C_{m_\alpha} + \frac{\rho A \ell^3}{4I_Y} C_{m_q} C_{N_\alpha} \right]$$

and

$$\hat{p} = \frac{I_x}{I_Y} \left(\frac{p\ell}{V}\right)$$

The dynamic stability factor is defined as:

$$S_d = \frac{2\left(C_{N_\alpha} - C_d + k_a^{-3} C_{m_{p\beta}}\right)}{C_{N_\alpha} - 2C_d - k_t^{-2}\left(C_{m_q} + C_{m_{\dot\alpha}}\right)}$$

(10)

At the time of booster separation, the flight conditions are:

$V = 5750$ ft/sec

$z = 4650$ ft

$\rho = 2.07 \times 10^{-3}$ slug/ft^3

$p = 503$ rad/sec

The geometric and aerodynamic parameters of the dart are:

$I_x = 2.36 \times 10^{-4}$ slug $-$ft^2

$I_Y = 0.1181$ slug $-$ft^2

$\ell = 0.0833$ft (ref. length taken as diameter)

$A = 0.00545$ft^2

$M = 0.155$ slugs

$C_{m_\alpha} = -32$/rad

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$$C_{N_\alpha} = 6.42/\text{rad}$$

$$C_{m_q} + C_{m_{\dot\alpha}} = -4350$$

$$C_{m_{p\beta}} = -1755$$

$$C_d = 0.25$$

$$k_a{}^2 = I_x/M\ell^2 = 0.219$$

$$k_t{}^2 = I_Y/M\ell^2 = 110$$

Applying the above data, the following is obtained.

$$4\hat{m}/\hat{p}^2 = -16,550$$

and,

$$S_d = -353$$

The requirement for dynamic stability is:

$$4\hat{m}/\hat{p}^2 - S_d (2-S_d) < 0 \tag{11}$$

For this configuration:

$$-16,550 + 125,200 > 0$$

The requirement for dynamic stability is not satisfied by the present configuration.

Further, a calculation of the critical roll rate at separation

$$p_c = \frac{1}{\pi I_x} \sqrt{\frac{qA\ell C_{m_\alpha} I_Y}{S_d(2-S_d)}} = 29.5 \text{ cps} \tag{12}$$

reveals that this value will be exceeded by the roll rate generated with a 30 minute fin cant (~80 cps). Consequently,

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means by which the dynamic stability can be improved are next considered.

It is noted that the gyroscopic stability factor varies inversely with roll rate and directly with dynamic pressure, whereas the dynamic stability factor is a function of the vehicle's external configuration, the mass moments of inertia and the stability margin. Since any changes in the moments of inertia and external geometry would require major design changes, the easiest way of improving the dynamic stability is to decrease the spin rate by decreasing the fin incidence angle. Before the spin rate can be arbitrarily decreased, the steady state pitch frequency must be calculated to determine how much the roll frequency may be reduced without getting into resonance problems. The pitch frequency (Figure 6) was calculated at various points along the trajectory according to the following equation:

$$ f = \frac{1}{2\pi} \sqrt{\frac{\rho V^2 A \ell C_{m_\alpha}}{2 I_Y}} \tag{13} $$

Also included in this plot as a function of time are the roll rates for the 30 minute fin cant and the critical roll rates for the configuration calculated from equations (7) and (12), respectively. It is seen that the roll rates for the 30 minute fin cant exceed the critical roll rates of the configuration. It is further evident that a sizable reduction in roll rate, which will fall below the critical roll rate and yet remain far enough above the pitching rate to avoid resonance problems, can be accomplished.

It was decided to compute a cant angle for the present configuration that would generate a roll rate approximately 50 percent higher than the natural pitching frequency at burnout, which is considered the most critical region. This should avoid resonance problems and still stay well below the critical spin rate. This angle was determined to be 6 minutes.

It should be noted that the preceding analysis is influenced to a large degree by the accuracy of the theoretical estimates of the pitch damping and Magnus moment coefficients. However, the approach is considered conservative and appropriate to determining means by which the dynamic stability of

a particular configuration can be improved.

The dynamic stability parameter, S_d, indicated in Figure 5 is probably quite conservative due to the value assumed for the Magnus moment coefficient. Consequently, the critical roll rate, p_c, indicated in Figure 6 is also conservative. Therefore, the altitude at which the configuration with the 6 minute fin cant exceeds the critical roll rate is in reality probably a good deal higher than that indicated. Therefore, the dart should fly well if the following items which contribute to the perturbations of the vehicle are not excessive: (1) booster thrust misalignments; (2) aerodynamic misalignments; and, (3) non-alignment of the booster dart.

AERODYNAMIC HEATING

Other areas in which failures would cause erratic flight and consequent difficulty in tracking the dart include aerodynamic heating of the motor casing, fins and nose cone.

The MK 32 MOD 0 motor, boosting the lighter 1.0-inch dart, attains higher velocities at lower altitudes with the consequence being higher heating rates than those for which it was designed. To make it as light as possible, the motor casing was designed to insure just enough strength, consequently, it was questionable if the rather critical margin of safety would be exceeded in the presence of the increased heating rates.

In order to determine whether the strength of the 3.0-inch diameter, 0.060-inch thick wall motor casing was exceeded, it was first necessary to determine the effect of the aerodynamic heating on the strength of the 2014-T6AL material used. The motor develops a chamber pressure of 1550 psia. The aerodynamic heating at two selected points on the rocket motor casing up to the time of separation was determined using the method of reference (10). The maximum motor stress was then calculated to see if this value exceeded the tensile yield strength of the motor casing at any time during the burning phase of the propellant. Figure 7 summarizes the results of these calculations. Aerodynamic heating at points 39.5 and 94.5 inches from the dart nose, as well as the tensile yield strength of the rocket motor casing are presented as functions of time. The calculations indicate that failure in the

immediate area of burnout (at approximately 1.9 seconds of burning) is possible. Further, it is conjectured that the failures would be random, i.e., some motor cases will remain intact while others will burst.

It has been recommended, in order to insure consistent performance, that an ablative coating be applied to the surface of the motor casing to minimize the effect of aerodynamic heating.

Other components of the system examined in the light of aerodynamic heating were the fins and nose cone. It was suspected that the aerodynamic heating experienced by the aluminum fins might have been severe enough to cause structural failure and subsequent erratic flight. Also of interest, especially for fuzing considerations, is the aerodynamic heating experienced by the nose cone. The pyro-mechanical fuze uses the aerodynamic heating of the nose cone to soften and melt a ring made of an eutectic alloy which allows the firing pin to be released starting the pyro delay train. This burns approximately 100 seconds and initiates the expelling charge in the fuze. Early release of the firing pin could result in premature initiation of the expelling charge and payload ejection.

The fin under consideration is an aluminum flat plate with a 60-degree swept, rounded leading edge and a thickness of 0.060 inches. An area near the center of the fin was chosen to be representative of the heating experienced by the fin. This area was 1.25 inches aft of the fin leading edge.

The nose cone is a tangent ogive made of carbon steel with a wall thickness of 0.204 inches. Two points on the nose cone, 6.032 and 11.422 inches aft of the nose tip, considered critical for the fuze were investigated.

The method used to estimate the fin and nose cone temperatures of the dart is the generally-accepted one of treating the heat flow into the wall as a one-dimensional problem; i.e., assuming that the heat flux parallel to the surface is small compared to that perpendicular to the surface. This technique, as indicated in reference (11), has been successful in predicting (somewhat conservatively) the actual heating rates experienced by other sounding rockets during their flight tests.

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The equation for wall temperature rise is:

$$\frac{dT(W)}{dt} = \left(\frac{A(W)}{RV(W)}\right)\frac{1}{C(W)}\left[H(T(R)-T(W))-E(W)ST(W)^4\right] \tag{14}$$

where H is assumed to be the local heat transfer coefficient correspondent to the location of interest.

The recovery factor is assumed to be equal to 0.89 or 0.84 depending on whether the flow is turbulent or laminar. Therefore, if the ratio of specific heats of air is 1.4, the expressions for the adiabatic wall temperatures, depending upon boundary layer type are:

$$T(R) = T(1+0.167M^2) \text{ (laminar)} \tag{15}$$
$$T(R) = T(1+0.178M^2) \text{ (turbulent)}$$

The only remaining unknown in equation (14) is the heat transfer coefficient, H. Now, the value of the heat transfer coefficient depends very critically on whether the flow is laminar or turbulent and, therefore, an estimation of both values is in order. The following expressions for a flat plate, derived from expressions for Nusselt numbers which assumed the Prandtl number for air to be constant and equal to 0.7, have been found to give good results.

$$H = 0.295 \frac{k}{X} RN^{0.5} \text{ (laminar)} \tag{16}$$

$$H = 0.0263 \frac{k}{X} RN^{0.8} \text{ (turbulent)} \tag{17}$$

However, experimental data obtained on yawed circular cylinders and swept leading edges have indicated that the heat transfer is reduced along the stagnation line by approximately the cosine of the yaw or sweep angle. Reference (12) speculates that this effect is probably present for some distance aft of the fin leading edge and indicates that the transitional region is not known with any degree of certainty. Therefore, in the present calculations the assumption has been made that the effect of sweep is present at the station in question. This assumption compensates for

the ultra-conservatism of equation (14). The expressions for
the heat transfer to a flat plate have been reduced by the
cosine of the sweep angle (cos 60° = 0.5) as follows:

$$H = 0.148 \frac{k}{X} RN^{0.5} \quad \text{(laminar)} \tag{18}$$

$$H = 0.0132 \frac{k}{X} RN^{0.8} \quad \text{(turbulent)} \tag{19}$$

Equations (18) and (19) were used to determine the heat
transfer coefficients for the fins. Equations (16) and (17),
according to reference (12), may be modified by multiplying
the constants by $\sqrt{3}$ and 1.15, respectively, to allow for the
three dimensional expansion over the nose cone. This yields
the following equations:

$$H = 0.512 \frac{k}{X} RN^{0.5} \quad \text{(laminar)} \tag{20}$$

$$H = 0.0302 \frac{k}{X} RN^{0.8} \quad \text{(turbulent)} \tag{21}$$

Equations (20) and (21) were used to determine the heat
transfer coefficients for the nose cone.

The free-stream Reynolds number of transition of the
boundary layer from laminar to turbulent flow was assumed to
be one million. Equations (18) and (20) were used when the
Reynolds number fell below this value. Equations (19) and
(21) were used when the converse was true.

The one-dimensional heat transfer analysis as outlined
in the preceding paragraphs was carried out on the IBM 7090
computer with the following printout: velocity, altitude,
Mach number, Reynolds number, adiabatic wall temperature, heat
flux and wall temperature as functions of time. The data so
computed are presented in Table 2. A key identifying the
various cases precedes the tabulated data and the character-
istics of the material under study appear at the head of each
case. The input data may be identified by referring to the
list of symbols included in this report.

Figure 8 indicates the heating and strength of the present
aluminum fin as a function of time. It is noted that the
tensile yield strength of the material goes to zero at approx-

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imately 2.5 seconds of flight time while the aerodynamic heating is still on the rise. This condition is, obviously, to be avoided. If existing fins are to be used, they should be fitted with a steel cuff on the leading edge and the walls given an ablative coating. A better approach would be to redesign the fin.

An acceptable fin, one that will retain structural integrity, may be made of stainless steel. Heat calculations using stainless steel and the present fin thickness of 0.060 inches were run and the tensile yield strength evaluated. Again, as shown in Figure 9, the strength of the fin appears inadequate. This was remedied, however, by simply increasing the fin thickness to 0.100 inches which then yielded results, Figure 9, that appear to meet the present requirements. It has been recommended that future fins be made according to the present planform but be made of 0.100 inches thick stainless steel and include a wedge leading edge.

Figure 10 shows the temperature history of the nose cone at two locations. This information was used in the design of the pyro-mechanical fuze.

CONCLUSIONS

It is concluded from the results of this study that aerodynamic instabilities or structural failure due to aerodynamic heating could have occurred in the first firings of the HASP 300,000 foot round.

Static stability considerations indicated the desirability of improving the static margin of the dart-booster combination. This could be accomplished most simply by adding weight to the forward end of the combination and, thereby, improving the center of gravity location. It is suggested that this could be done by replacing the present 5 pound dart with a 6 pound version. The trajectory studies have indicated that a 6 pound dart in conjunction with the MK 32 MOD 0 motor will still reach an altitude of 300,000 feet with a quadrant elevation of 80 degrees.

The dynamic stability analysis was influenced to a large degree by the accuracy of the theoretical estimates of the pitch damping and Magnus moment coefficients. However, the approach used is considered conservative. The calculations

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indicated that the present fin-cant angle of 30 minutes for the 1.0-inch dart is not optimum and may in fact contribute to dynamic instability. The optimum fin-cant angle was determined to be 6 minutes. It is recommended that this fin incidence angle be included in subsequent dart configurations built for field tests.

Aerodynamic heating studies conducted on the MK 32 MOD 0 motor casing indicated a marginal condition which, to avoid random performance, should be corrected by providing the motor casings with an ablative coating. The aerodynamic heating studies on the dart also revealed the inadequacy of the present 0.060-inch thick aluminum fins to maintain structural integrity, and make it imperative that future fins be constructed of 0.100-inch thick stainless steel.

In summary, it is recommended that the following corrective measures be applied to the HASP 300,000 foot system prior to any future field testing:

    a.   Change the dart weight from 5 to 6 pounds.

    b.   Change the dart fin incidence angle from 30 to 6 minutes.

    c.   Change the fin material from 0.060-inch thick aluminum to 0.100-inch thick stainless steel.

    d.   Provide the motor casing with an ablative coating.

259.9	3802.9	56696.1	-84.2	103659.0	0.4	5.0	3.1
260.9	3813.0	52907.3	-84.2	104044.3	0.3	5.0	3.7
261.9	3818.7	49110.3	-84.3	104427.3	0.1	5.0	4.5
262.9	3819.1	45309.9	-84.3	104807.3	0.1	5.0	5.3
263.9	3813.3	41511.8	-84.4	105184.0	0.3	5.0	6.4
264.9	3800.2	37722.6	-84.4	105556.6	0.5	5.0	7.6
265.9	3778.9	33950.2	-84.5	105924.4	0.8	5.0	8.9
266.9	3749.7	30202.7	-84.5	106286.7	1.0	5.0	10.1
267.9	3712.0	26488.2	-84.5	106642.7	1.3	5.0	11.5
268.9	3665.6	22815.2	-84.6	106991.7	1.6	5.0	12.9
269.9	3610.2	19192.5	-84.6	107332.9	1.9	5.0	14.3
270.9	3545.6	15629.3	-84.7	107665.5	2.2	5.0	15.7
271.9	3471.9	12134.8	-84.7	107988.8	2.4	5.0	17.1
272.9	3389.3	8717.8	-84.8	108302.0	2.7	5.0	18.5
273.9	3298.2	5387.1	-84.8	108604.3	3.0	5.0	19.8
274.9	3199.2	2150.8	-84.9	108895.2	3.2	5.0	20.9
275.6	3127.5	-0.0	-84.9	109087.0	3.3	5.0	21.7

RUN 2A

INITIAL DATA

Z(0)= 0.	AL= 1.3089E 00	V(0)= 10.0000E-02
ISP(0)= 2.3323E 02	K(T)= 6.4800E-01	D(B)= 8.3333E-02
D(M)= 2.5000E-01	M(B)= 1.5540E-01	M(0)= 8.7743E-01
M(P)= 5.2278E-01	MR= 2.8110E-01	

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
.	0.1	0.	75.0	0.	70.7	28.2	0.0
.1	231.3	11.1	74.5	3.1	73.0	27.3	1.1
.2	470.2	44.8	74.3	12.5	75.4	26.4	4.6
0.3	716.9	101.9	74.2	28.6	77.9	25.5	10.7
0.4	971.6	183.0	74.2	51.5	80.5	24.6	19.5
0.5	1234.7	289.1	74.1	81.6	83.1	23.7	31.5
0.6	1506.4	420.8	74.1	119.1	85.8	22.8	46.6
0.7	1786.7	579.1	74.1	164.3	88.5	21.9	65.3
0.8	2076.1	764.7	74.0	217.3	91.3	21.0	87.7
0.9	2374.5	978.6	74.0	278.6	94.2	20.1	114.0
1.0	2682.4	1221.6	74.0	348.2	97.2	19.2	144.4
1.1	2999.8	1494.6	74.0	426.6	100.2	18.3	179.2
1.2	3326.9	1798.5	74.0	514.0	103.2	17.4	218.4
1.3	3664.0	2134.4	73.9	610.6	106.3	16.5	262.3
1.4	4011.2	2503.1	73.9	716.7	109.5	15.6	310.9
1.5	4368.7	2905.6	73.9	832.7	112.7	14.7	364.4
1.6	4736.8	3343.0	73.9	958.8	116.1	13.8	422.9
1.7	5115.6	3816.2	73.9	1095.4	119.5	12.9	486.3
1.8	5505.6	4326.3	73.9	1242.7	123.0	11.9	554.7
1.9	5744.2	4649.2	73.9	1336.0	125.1	11.4	597.9
1.9	5744.2	4649.2	73.9	1336.0	11.2	5.0	51.1
2.9	5425.7	10007.2	73.8	2888.9	8.8	5.0	39.0
3.9	5173.5	15090.5	73.7	4371.3	7.0	5.0	30.3
4.9	4969.3	19953.3	73.6	5798.6	5.7	5.0	23.9
5.9	4801.0	24635.7	73.5	7182.2	4.8	5.0	19.1
6.9	4660.2	29167.9	73.4	8530.9	4.0	5.0	15.3
7.9	4540.9	33573.2	73.3	9851.2	3.4	5.0	12.4
8.9	4438.7	37870.1	73.1	11148.5	2.9	5.0	9.9
9.9	4351.5	42073.8	73.0	12427.4	2.5	5.0	7.8
10.9	4276.0	46197.3	72.9	13691.5	2.2	5.0	6.2
11.9	4209.6	50250.3	72.8	14943.8	2.0	5.0	5.0
12.9	4150.2	54240.6	72.6	16186.6	1.8	5.0	4.0
13.9	4096.4	58174.1	72.5	17421.7	1.6	5.0	3.3
14.9	4047.0	62055.6	72.4	18650.4	1.5	5.0	2.6
15.9	4001.1	65888.8	72.2	19873.9	1.4	5.0	2.2
16.9	3958.0	69676.8	72.1	21093.2	1.3	5.0	1.8
17.9	3917.3	73421.9	71.9	22309.0	1.3	5.0	1.5
18.9	3878.4	77126.1	71.8	23521.8	1.2	5.0	1.2
19.9	3841.1	80791.0	71.6	24732.3	1.2	5.0	1.0
20.9	3805.0	84418.0	71.5	25940.7	1.1	5.0	0.8
21.9	3770.0	88008.0	71.3	27147.5	1.1	5.0	0.7
22.9	3735.9	91562.1	71.2	28352.9	1.1	5.0	0.6
23.9	3702.5	95080.8	71.0	29557.1	1.1	5.0	0.5

TABLE 1

TABULATED TRAJECTORY DATA

Key to Tabulated Data

Run	QE	ISP
1A	75	lower
2A		upper
1B	80	lower
2B		upper
1C	85	lower
2C		upper

INITIAL DATA

Z(0)= 0.   AL= 1.3089E 00 V(0)= 10.0000E-02
ISP(0)= 2.2623E 02 K(T)= 6.4800E-01 D(B)= 8.3333E-02
D(M)= 2.5000E-01 M(B)= 1.5540E-01 M(0)= 8.7743E-01
M(P)= 5.2278E-01 MR= 2.7514E-01

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
0.	0.1	0.	75.0	0.	67.0	28.2	0.0
0.1	219.1	10.5	74.4	2.9	69.2	27.3	1.0
0.2	445.2	42.4	74.3	11.9	71.4	26.5	4.1
0.3	678.5	96.4	74.2	27.1	73.7	25.6	9.6
0.4	919.4	173.2	74.1	48.9	76.1	24.7	17.5
0.5	1168.0	273.6	74.1	77.5	78.5	23.8	28.2
0.6	1424.5	398.1	74.0	113.0	81.0	22.9	41.7
0.7	1689.1	547.7	74.0	155.9	83.5	22.0	58.4
0.8	1962.0	723.1	74.0	206.2	86.1	21.1	78.4
0.9	2243.4	925.2	74.0	264.2	88.8	20.3	101.9
1.0	2533.6	1154.6	73.9	330.3	91.6	19.4	129.1
1.1	2832.6	1412.4	73.9	404.6	94.3	18.5	160.2
1.2	3140.7	1699.3	73.9	487.3	97.2	17.6	195.2
1.3	3458.1	2016.2	73.9	578.8	100.1	16.7	234.5
1.4	3784.8	2364.0	73.9	679.4	103.1	15.8	278.0
1.5	4121.3	2743.6	73.9	789.3	106.1	14.9	325.9
1.6	4467.5	3156.1	73.8	908.7	109.2	14.1	378.3
1.7	4823.9	3602.2	73.8	1038.0	112.3	13.2	435.2
1.8	5190.6	4083.0	73.8	1177.4	115.6	12.3	496.6
1.9	5568.0	4599.5	73.8	1327.3	119.0	11.4	562.6
1.9	5568.2	4599.8	73.8	1327.4	119.0	11.4	562.7
1.9	5568.2	4599.8	73.8	1327.4	10.6	5.0	48.4
2.9	5264.0	9794.2	73.7	2839.8	8.4	5.0	37.2
3.9	5021.3	14725.2	73.6	4284.6	6.8	5.0	29.1
4.9	4823.5	19443.4	73.5	5676.4	5.6	5.0	23.1
5.9	4659.6	23986.3	73.4	7025.8	4.7	5.0	18.5
6.9	4521.7	28382.4	73.3	8341.0	4.0	5.0	14.9
7.9	4404.1	32654.0	73.2	9628.5	3.4	5.0	12.1
8.9	4302.9	36818.5	73.0	10893.2	2.9	5.0	9.8
9.9	4215.8	40890.3	72.9	12139.5	2.5	5.0	7.8
10.9	4140.1	44881.7	72.8	13371.0	2.2	5.0	6.3
11.9	4073.3	48802.5	72.7	14590.4	2.0	5.0	5.0
12.9	4013.5	52660.1	72.5	15800.2	1.8	5.0	4.1
13.9	3959.2	56460.6	72.4	17002.1	1.6	5.0	3.3
14.9	3909.3	60208.5	72.2	18197.4	1.5	5.0	2.7
15.9	3862.9	63907.7	72.1	19387.3	1.4	5.0	2.2
16.9	3819.4	67561.1	71.9	20572.9	1.3	5.0	1.8
17.9	3778.3	71171.2	71.8	21754.7	1.3	5.0	1.5
18.9	3739.0	74740.1	71.6	22933.4	1.2	5.0	1.3
19.9	3701.3	78269.2	71.5	24109.6	1.2	5.0	1.0
20.9	3664.8	81760.0	71.3	25283.7	1.2	5.0	0.9
21.9	3629.5	85213.6	71.2	26455.9	1.1	5.0	0.7
22.9	3595.0	88630.8	71.0	27626.6	1.1	5.0	0.6

23.9	3561.4	92012.4	70.8	28796.1	1.1	5.0	0.5
24.9	3528.3	95359.1	70.7	29964.5	1.1	5.0	0.4
25.9	3495.8	98671.4	70.5	31132.0	1.1	5.0	0.4
26.9	3463.7	101949.6	70.3	32298.8	1.0	5.0	0.3
27.9	3431.9	105194.2	70.1	33464.9	1.0	4.9	0.3
28.9	3400.5	108405.4	70.0	34630.4	1.0	4.9	0.2
29.9	3369.4	111583.5	69.8	35795.5	1.0	4.9	0.2
30.9	3338.4	114728.6	69.6	36960.2	1.0	4.9	0.2
31.9	3307.7	117841.0	69.4	38124.5	1.0	4.9	0.1
32.9	3277.1	120920.8	69.2	39288.6	1.0	4.9	0.1
33.9	3246.7	123968.0	69.0	40452.3	1.0	4.9	0.1
34.9	3216.5	126982.9	68.8	41615.9	1.0	4.9	0.1
35.9	3186.4	129965.5	68.6	42779.2	1.0	4.9	0.1
36.9	3156.4	132915.8	68.4	43942.4	1.0	4.9	0.1
37.9	3126.5	135834.0	68.2	45105.4	1.0	4.9	0.1
38.9	3096.7	138720.1	67.9	46268.2	1.0	4.9	0.0
39.9	3067.0	141574.1	67.7	47431.0	1.0	4.9	0.0
40.9	3037.4	144396.2	67.5	48593.6	1.0	4.9	0.0
41.9	3007.8	147186.2	67.3	49756.2	1.0	4.9	0.0
42.9	2978.4	149944.4	67.0	50918.6	1.0	4.9	0.0
43.9	2949.0	152670.6	66.8	52081.0	1.0	4.9	0.0
44.9	2919.8	155365.0	66.5	53243.3	1.0	4.9	0.0
45.9	2890.6	158027.5	66.3	54405.6	1.0	4.9	0.0
46.9	2861.5	160658.3	66.0	55567.8	1.0	4.9	0.0
47.9	2832.4	163257.2	65.8	56729.9	1.0	4.9	0.0
48.9	2803.5	165824.4	65.5	57892.0	1.0	4.9	0.0
49.9	2774.6	168359.7	65.2	59054.1	1.0	4.9	0.0
50.9	2745.8	170863.4	65.0	60216.1	1.0	4.9	0.0
51.9	2717.1	173335.3	64.7	61378.1	1.0	4.9	0.0
52.9	2688.4	175775.5	64.4	62540.1	1.0	4.9	0.0
53.9	2659.9	178184.1	64.1	63702.0	1.0	4.9	0.0
54.9	2631.4	180560.9	63.8	64864.0	1.0	4.9	0.0
55.9	2603.0	182906.1	63.5	66025.8	1.0	4.9	0.0
56.9	2574.7	185219.6	63.2	67187.7	1.0	4.9	0.0
57.9	2546.5	187501.4	62.9	68349.6	1.0	4.9	0.0
58.9	2518.4	189751.6	62.5	69511.4	1.0	4.9	0.0
59.9	2490.4	191970.2	62.2	70673.2	1.0	4.9	0.0
60.9	2462.5	194157.2	61.8	71835.0	1.0	4.9	0.0
61.9	2434.6	196312.5	61.5	72996.8	1.0	4.9	0.0
62.9	2406.9	198436.3	61.1	74158.5	1.0	4.9	0.0
63.9	2379.3	200528.4	60.8	75320.3	1.0	4.9	0.0
64.9	2351.8	202589.0	60.4	76482.0	1.0	4.9	0.0
65.9	2324.4	204618.0	60.0	77643.8	1.0	4.9	0.0
66.9	2297.1	206615.4	59.6	78805.5	1.0	4.9	0.0
67.9	2269.9	208581.3	59.2	79967.2	1.0	4.9	0.0
68.9	2242.8	210515.6	58.8	81128.9	1.0	4.9	0.0
69.9	2215.9	212418.4	58.4	82290.6	1.0	4.9	0.0
70.9	2189.1	214289.6	57.9	83452.3	1.0	4.9	0.0
71.9	2162.5	216129.3	57.5	84614.0	1.0	4.9	0.0
72.9	2135.9	217937.5	57.1	85775.7	1.0	4.9	0.0
73.9	2109.6	219714.1	56.6	86937.3	1.0	4.9	0.0
74.9	2083.3	221459.3	56.1	88099.0	1.0	4.9	0.0
75.9	2057.2	223172.9	55.6	89260.7	1.0	4.9	0.0
76.9	2031.3	224855.0	55.1	90422.3	1.0	4.9	0.0
77.9	2005.6	226505.6	54.6	91584.0	1.0	4.9	0.0
78.9	1980.0	228124.8	54.1	92745.6	1.0	4.9	0.0
79.9	1954.6	229712.4	53.5	93907.3	1.0	4.9	0.0
80.9	1929.3	231268.6	53.0	95068.9	1.0	4.9	0.0
81.9	1904.3	232793.3	52.4	96230.6	1.0	4.9	0.0

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82.9	1879.5	234286.5	51.8	97392.2	1.0	4.9	0.0
83.9	1854.8	235748.2	51.2	98553.8	1.0	4.9	0.0
84.9	1830.4	237178.5	50.6	99715.5	1.0	4.9	0.0
85.9	1806.2	238577.4	50.0	100877.1	1.0	4.9	0.0
86.9	1782.2	239944.7	49.3	102038.7	1.0	4.9	0.0
87.9	1758.5	241280.7	48.7	103200.4	1.0	4.9	0.0
88.9	1735.0	242585.1	48.0	104362.0	1.0	4.9	0.0
89.9	1711.8	243858.2	47.3	105523.6	1.0	4.9	0.0
90.9	1688.8	245099.8	46.5	106685.2	1.0	4.9	0.0
91.9	1666.2	246310.0	45.8	107846.8	1.0	4.9	0.0
92.9	1643.8	247488.7	45.0	109008.5	1.0	4.9	0.0
93.9	1621.7	248636.0	44.3	110170.1	1.0	4.9	0.0
94.9	1599.9	249751.9	43.4	111331.7	1.0	4.9	0.0
95.9	1578.5	250836.4	42.6	112493.3	1.0	4.9	0.0
96.9	1557.4	251889.5	41.8	113654.9	1.0	4.9	0.0
97.9	1536.6	252911.1	40.9	114816.5	1.0	4.9	0.0
98.9	1516.3	253901.4	40.0	115978.1	1.0	4.9	0.0
99.9	1496.3	254860.2	39.1	117139.8	1.0	4.9	0.0
100.9	1476.7	255787.7	38.1	118301.4	1.0	4.9	0.0
101.9	1457.5	256683.7	37.2	119463.0	1.0	4.9	0.0
102.9	1438.8	257548.3	36.2	120624.6	1.0	4.9	0.0
103.9	1420.5	258381.6	35.1	121786.2	1.0	4.9	0.0
104.9	1402.6	259183.4	34.1	122947.8	1.0	4.9	0.0
105.9	1385.3	259953.9	33.0	124109.4	1.0	4.9	0.0
106.9	1368.4	260693.0	31.9	125271.0	1.0	4.9	0.0
107.9	1352.1	261400.7	30.8	126432.6	1.0	4.9	0.0
108.9	1336.3	262077.0	29.6	127594.2	1.0	4.9	0.0
109.9	1321.1	262721.9	28.4	128755.8	1.0	4.9	0.0
110.9	1306.4	263335.5	27.2	129917.4	1.0	4.9	0.0
111.9	1292.4	263917.6	26.0	131079.0	1.0	4.9	0.0
112.9	1278.9	264468.4	24.7	132240.6	1.0	4.9	0.0
113.9	1266.1	264987.9	23.4	133402.2	1.0	4.9	0.0
114.9	1254.0	265475.9	22.1	134563.8	1.0	4.9	0.0
115.9	1242.5	265932.6	20.8	135725.4	1.0	4.9	0.0
116.9	1231.7	266357.9	19.4	136887.0	1.0	4.9	0.0
117.9	1221.6	266751.8	18.0	138048.6	1.0	4.9	0.0
118.9	1212.3	267114.4	16.6	139210.2	1.0	4.9	0.0
119.9	1203.7	267445.6	15.2	140371.8	1.0	4.9	0.0
120.9	1195.9	267745.5	13.7	141533.4	1.0	4.9	0.0
121.9	1188.8	268014.0	12.3	142695.0	1.0	4.9	0.0
122.9	1182.5	268251.1	10.8	143856.6	1.0	4.9	0.0
123.9	1177.0	268456.8	9.3	145018.2	1.0	4.9	0.0
124.9	1172.4	268631.2	7.8	146179.8	1.0	4.9	0.0
125.9	1168.6	268774.3	6.3	147341.4	1.0	4.9	0.0
126.9	1165.6	268885.9	4.7	148503.0	1.0	4.9	0.0
127.9	1163.4	268966.3	3.2	149664.6	1.0	4.9	0.0
128.9	1162.1	269015.2	1.6	150826.2	1.0	4.9	0.0
129.9	1161.6	269032.8	0.1	151987.8	1.0	4.9	0.0
130.9	1162.0	269019.0	-1.5	153149.4	1.0	4.9	0.0
131.9	1163.2	268973.9	-3.0	154311.0	1.0	4.9	0.0
132.9	1165.2	268897.4	-4.5	155472.6	1.0	4.9	0.0
133.9	1168.1	268789.6	-6.1	156634.1	1.0	4.9	0.0
134.9	1171.9	268650.4	-7.6	157795.7	1.0	4.9	0.0
135.9	1176.4	268479.8	-9.1	158957.3	1.0	4.9	0.0
136.9	1181.8	268277.9	-10.6	160118.9	1.0	4.9	0.0
137.9	1188.0	268044.6	-12.1	161280.5	1.0	4.9	0.0
138.9	1194.9	267779.9	-13.6	162442.1	1.0	4.9	0.0
139.9	1202.7	267483.9	-15.0	163603.7	1.0	4.9	0.0
140.9	1211.2	267156.6	-16.5	164765.3	1.0	4.9	0.0

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141.9	1220.4	266797.8	-17.9	165926.9	1.0	4.9	0.0
142.9	1230.4	266407.7	-19.3	167088.5	1.0	4.9	0.0
143.9	1241.1	265986.2	-20.6	168250.0	1.0	4.9	0.0
144.9	1252.5	265533.4	-22.0	169411.6	1.0	4.9	0.0
145.9	1264.6	265049.1	-23.3	170573.2	1.0	4.9	0.0
146.9	1277.3	264533.6	-24.6	171734.8	1.0	4.9	0.0
147.9	1290.7	263986.6	-25.8	172896.4	1.0	4.9	0.0
148.9	1304.7	263408.3	-27.1	174058.0	1.0	4.9	0.0
149.9	1319.2	262798.5	-28.3	175219.6	1.0	4.9	0.0
150.9	1334.4	262157.4	-29.5	176381.2	1.0	4.9	0.0
151.9	1350.1	261485.0	-30.6	177542.7	1.0	4.9	0.0
152.9	1366.4	260781.1	-31.8	178704.3	1.0	4.9	0.0
153.9	1383.2	260045.9	-32.9	179865.9	1.0	4.9	0.0
154.9	1400.5	259279.3	-34.0	181027.5	1.0	4.9	0.0
155.9	1418.2	258481.3	-35.0	182189.1	1.0	4.9	0.0
156.9	1436.5	257651.9	-36.0	183350.6	1.0	4.9	0.0
157.9	1455.2	256791.1	-37.0	184512.2	1.0	4.9	0.0
158.9	1474.3	255898.9	-38.0	185673.8	1.0	4.9	0.0
159.9	1493.8	254975.3	-39.0	186835.4	1.0	4.9	0.0
160.9	1513.8	254020.3	-39.9	187997.0	1.0	4.9	0.0
161.9	1534.1	253033.9	-40.8	189158.5	1.0	4.9	0.0
162.9	1554.8	252016.1	-41.7	190320.1	1.0	4.9	0.0
163.9	1575.8	250966.9	-42.5	191481.7	1.0	4.9	0.0
164.9	1597.2	249886.3	-43.3	192643.3	1.0	4.9	0.0
165.9	1619.0	248774.2	-44.2	193804.8	1.0	4.9	0.0
166.9	1641.0	247630.8	-44.9	194966.4	1.0	4.9	0.0
167.9	1663.4	246455.9	-45.7	196128.0	1.0	4.9	0.0
168.9	1686.0	245249.6	-46.5	197289.5	1.0	4.9	0.0
169.9	1708.9	244011.9	-47.2	198451.1	1.0	4.9	0.0
170.9	1732.1	242742.7	-47.9	199612.7	1.0	4.9	0.0
171.9	1755.5	241442.1	-48.6	200774.2	1.0	4.9	0.0
172.9	1779.2	240110.1	-49.2	201935.8	1.0	4.9	0.0
173.9	1803.2	238746.6	-49.9	203097.3	1.0	4.9	0.0
174.9	1827.3	237351.6	-50.5	204258.9	1.0	4.9	0.0
175.9	1851.7	235925.2	-51.2	205420.5	1.0	4.9	0.0
176.9	1876.3	234467.4	-51.8	206582.0	1.0	4.9	0.0
177.9	1901.1	232978.1	-52.3	207743.6	1.0	4.9	0.0
178.9	1926.1	231457.4	-52.9	208905.1	1.0	4.9	0.0
179.9	1951.3	229905.1	-53.5	210066.6	1.0	4.9	0.0
180.9	1976.7	228321.4	-54.0	211228.2	1.0	4.9	0.0
181.9	2002.3	226706.2	-54.5	212389.7	1.0	4.9	0.0
182.9	2028.0	225059.6	-55.1	213551.3	1.0	4.9	0.0
183.9	2053.9	223381.4	-55.6	214712.8	1.0	4.9	0.0
184.9	2079.9	221671.8	-56.1	215874.3	1.0	4.9	0.0
185.9	2106.1	219930.7	-56.5	217035.8	1.0	4.9	0.0
186.9	2132.5	218158.1	-57.0	218197.3	1.0	4.9	0.0
187.9	2158.9	216353.9	-57.5	219358.8	1.0	4.9	0.0
188.9	2185.6	214518.3	-57.9	220520.4	1.0	4.9	0.0
189.9	2212.3	212651.2	-58.3	221681.8	1.0	4.9	0.0
190.9	2239.2	210752.5	-58.8	222843.3	1.0	4.9	0.0
191.9	2266.2	208822.3	-59.2	224004.8	1.0	4.9	0.0
192.9	2293.3	206860.6	-59.6	225166.3	1.0	4.9	0.0
193.9	2320.6	204867.3	-60.0	226327.8	1.0	4.9	0.0
194.9	2347.9	202842.6	-60.4	227489.2	1.0	4.9	0.0
195.9	2375.4	200786.3	-60.7	228650.7	1.0	4.9	0.0
196.9	2403.0	198698.4	-61.1	229812.1	1.0	4.9	0.0
197.9	2430.6	196579.0	-61.5	230973.5	1.0	4.9	0.0
198.9	2458.4	194428.0	-61.8	232134.9	1.0	4.9	0.0
199.9	2486.2	192245.5	-62.2	233296.3	1.0	4.9	0.0

200.9	2514.2	190031.4	-62.5	234457.7	1.0	4.9	0.0
201.9	2542.2	187785.8	-62.8	235619.1	1.0	4.9	0.0
202.9	2570.3	185508.6	-63.1	236780.4	1.0	4.9	0.0
203.9	2598.5	183199.8	-63.5	237941.7	1.0	4.9	0.0
204.9	2626.8	180859.5	-63.8	239103.0	1.0	4.9	0.0
205.9	2655.1	178487.6	-64.1	240264.3	1.0	4.9	0.0
206.9	2683.5	176084.1	-64.4	241425.6	1.0	4.9	0.0
207.9	2712.0	173649.0	-64.6	242586.8	1.0	4.9	0.0
208.9	2740.6	171182.3	-64.9	243748.0	1.0	4.9	0.0
209.9	2769.2	168684.1	-65.2	244909.2	1.0	4.9	0.0
210.9	2797.9	166154.3	-65.5	246070.3	1.0	4.9	0.0
211.9	2826.7	163592.9	-65.7	247231.4	1.0	4.9	0.0
212.9	2855.5	160999.9	-66.0	248392.4	1.0	4.9	0.0
213.9	2884.3	158375.3	-66.3	249553.4	1.0	4.9	0.0
214.9	2913.2	155719.2	-66.5	250714.3	1.0	4.9	0.0
215.9	2942.2	153031.5	-66.8	251875.2	1.0	4.9	0.0
216.9	2971.1	150312.3	-67.0	253036.0	1.0	4.9	0.0
217.9	3000.2	147561.5	-67.2	254196.8	1.0	4.9	0.0
218.9	3029.2	144779.2	-67.5	255357.4	1.0	4.9	0.0
219.9	3058.3	141965.4	-67.7	256518.0	1.0	4.9	0.0
220.9	3087.4	139120.1	-67.9	257678.4	1.0	4.9	0.0
221.9	3116.5	136243.4	-68.1	258838.8	1.0	4.9	0.1
222.9	3145.6	133335.2	-68.4	259999.0	1.0	4.9	0.1
223.9	3174.7	130395.7	-68.6	261159.0	1.0	4.9	0.1
224.9	3203.8	127424.8	-68.8	262318.9	1.0	4.9	0.1
225.9	3232.9	124422.6	-69.0	263478.6	1.0	4.9	0.1
226.9	3261.9	121389.2	-69.2	264638.1	1.0	4.9	0.1
227.9	3290.9	118324.7	-69.4	265797.3	1.0	4.9	0.1
228.9	3319.8	115229.2	-69.6	266956.2	1.0	4.9	0.2
229.9	3348.6	112102.7	-69.8	268114.7	1.0	4.9	0.2
230.9	3377.3	108945.5	-69.9	269272.9	1.0	4.9	0.2
231.9	3405.8	105757.7	-70.1	270430.6	0.9	4.9	0.2
232.9	3434.0	102539.5	-70.3	271587.8	0.9	5.0	0.3
233.9	3462.1	99291.2	-70.5	272744.4	0.9	5.0	0.3
234.9	3489.8	96013.0	-70.7	273900.3	0.9	5.0	0.4
235.9	3517.1	92705.4	-70.8	275055.3	0.9	5.0	0.5
236.9	3543.9	89368.8	-71.0	276209.2	0.9	5.0	0.6
237.9	3570.1	86003.7	-71.2	277362.1	0.9	5.0	0.7
238.9	3595.5	82610.9	-71.3	278513.5	0.8	5.0	0.8
239.9	3620.1	79191.1	-71.5	279663.2	0.8	5.0	1.0
240.9	3643.6	75745.3	-71.7	280810.9	0.8	5.0	1.2
241.9	3665.8	72274.6	-71.8	281956.3	0.7	5.0	1.4
242.9	3686.5	68780.4	-72.0	283099.0	0.7	5.0	1.6
243.9	3705.4	65264.3	-72.1	284238.3	0.6	5.0	2.0
244.9	3722.0	61728.3	-72.3	285373.8	0.6	5.0	2.3
245.9	3736.1	58174.6	-72.4	286504.7	0.5	5.0	2.8
246.9	3747.0	54606.0	-72.6	287630.2	0.4	5.0	3.3
247.9	3754.3	51025.8	-72.7	288749.2	0.3	5.0	4.0
248.9	3757.1	47438.0	-72.9	289860.7	0.3	5.0	4.7
249.9	3754.8	43847.1	-73.0	290963.3	0.3	5.0	5.6
250.9	3746.4	40258.5	-73.1	292055.4	0.5	5.0	6.6
251.9	3731.0	36678.5	-73.3	293135.1	0.7	5.0	7.8
252.9	3708.0	33114.2	-73.4	294200.5	0.9	5.0	8.9
253.9	3677.8	29572.8	-73.6	295249.6	1.1	5.0	10.1
254.9	3639.8	26061.5	-73.7	296280.3	1.3	5.0	11.3
255.9	3593.9	22588.0	-73.9	297290.6	1.6	5.0	12.6
256.9	3539.6	19160.0	-74.0	298278.5	1.8	5.0	13.9
257.9	3477.1	15785.8	-74.1	299241.7	2.1	5.0	15.2
258.9	3406.3	12473.2	-74.3	300178.3	2.3	5.0	16.4

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259.9	3327.5	9230.4	-74.4	301086.2	2.6	5.0	17.7
260.9	3241.0	6064.9	-74.6	301963.6	2.8	5.0	18.8
261.9	3147.3	2984.0	-74.7	302808.8	3.0	5.0	19.9
262.9	3047.3	-0.0	-74.9	303618.9	3.2	5.0	20.9

INITIAL DATA

$Z(0) = 0.$ $AL = 1.3962E\ 00$ $V(0) = 10.0000E-02$
$ISP(0) = 2.2623E\ 02$ $K(T) = 6.4800E-01$ $D(B) = 8.3333E-02$
$D(M) = 2.5000E-01$ $M(B) = 1.5540E-01$ $M(0) = 8.7743E-01$
$M(P) = 5.2278E-01$ $MR = 2.7514E-01$

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
0.	0.1	0.	80.0	0.	67.0	28.2	0.0
0.1	219.0	10.7	79.6	1.9	69.1	27.3	1.0
0.2	445.0	43.3	79.5	8.0	71.4	26.5	4.1
0.3	678.3	98.5	79.5	18.2	73.7	25.6	9.5
0.4	919.1	176.9	79.4	32.8	76.0	24.7	17.5
0.5	1167.6	279.4	79.4	52.0	78.5	23.8	28.1
0.6	1424.1	406.7	79.4	75.9	81.0	22.9	41.7
0.7	1688.6	559.6	79.3	104.7	83.5	22.0	58.4
0.8	1961.5	738.9	79.3	138.5	86.1	21.1	78.3
0.9	2242.9	945.4	79.3	177.5	88.8	20.3	101.8
1.0	2533.0	1179.9	79.3	221.8	91.5	19.4	129.0
1.1	2832.0	1443.4	79.3	271.7	94.3	18.5	159.9
1.2	3140.1	1736.7	79.3	327.3	97.2	17.6	194.9
1.3	3457.5	2060.8	79.3	388.8	100.1	16.7	234.1
1.4	3784.3	2416.4	79.2	456.3	103.1	15.8	277.5
1.5	4120.8	2804.6	79.2	530.2	106.1	14.9	325.2
1.6	4467.2	3226.4	79.2	610.4	109.2	14.1	377.4
1.7	4823.8	3682.7	79.2	697.3	112.4	13.2	434.1
1.8	5190.8	4174.4	79.2	791.0	115.7	12.3	495.3
1.9	5568.5	4702.8	79.2	891.7	119.1	11.4	561.0
1.9	5568.7	4703.1	79.2	891.7	119.1	11.4	561.0
1.9	5568.7	4703.1	79.2	891.7	10.6	5.0	48.3
2.9	5265.2	10017.6	79.1	1908.3	8.4	5.0	36.9
3.9	5023.6	15065.0	79.1	2879.7	6.7	5.0	28.8
4.9	4827.1	19897.3	79.0	3815.8	5.5	5.0	22.8
5.9	4664.6	24553.0	78.9	4723.9	4.6	5.0	18.2
6.9	4528.1	29061.3	78.8	5609.4	3.9	5.0	14.6
7.9	4412.0	33444.9	78.8	6476.6	3.3	5.0	11.8
8.9	4312.2	37721.7	78.7	7329.0	2.9	5.0	9.5
9.9	4226.6	41906.5	78.6	8169.4	2.5	5.0	7.5
10.9	4152.2	46011.9	78.5	9000.2	2.2	5.0	6.0
11.9	4086.5	50047.5	78.4	9823.4	1.9	5.0	4.8
12.9	4027.4	54020.8	78.3	10640.4	1.8	5.0	3.9
13.9	3973.8	57937.7	78.2	11452.4	1.6	5.0	3.1
14.9	3924.3	61802.9	78.1	12260.3	1.5	5.0	2.5
15.9	3878.2	65620.0	78.1	13064.7	1.4	5.0	2.1
16.9	3834.8	69392.1	78.0	13866.4	1.3	5.0	1.7
17.9	3793.6	73121.4	77.9	14665.9	1.3	5.0	1.4
18.9	3754.2	76810.0	77.7	15463.4	1.2	5.0	1.2
19.9	3716.3	80459.3	77.6	16259.3	1.2	5.0	1.0
20.9	3679.5	84070.7	77.5	17053.9	1.1	5.0	0.8
21.9	3643.8	87645.3	77.4	17847.5	1.1	5.0	0.6
22.9	3608.9	91183.8	77.3	18640.1	1.1	5.0	0.5

23.9	3574.7	94687.2	77.2	19431.9	1.1	5.0	0.4
24.9	3541.0	98155.9	77.1	20223.2	1.1	5.0	0.4
25.9	3507.8	101590.4	77.0	21013.9	1.1	5.0	0.3
26.9	3474.9	104991.0	76.9	21804.1	1.0	4.9	0.3
27.9	3442.4	108358.3	76.7	22594.0	1.0	4.9	0.2
28.9	3410.1	111692.3	76.6	23383.6	1.0	4.9	0.2
29.9	3378.1	114993.3	76.5	24172.9	1.0	4.9	0.2
30.9	3346.2	118261.5	76.4	24961.9	1.0	4.9	0.1
31.9	3314.5	121497.0	76.2	25750.8	1.0	4.9	0.1
32.9	3282.9	124700.1	76.1	26539.4	1.0	4.9	0.1
33.9	3251.5	127870.7	76.0	27327.9	1.0	4.9	0.1
34.9	3220.2	131009.0	75.8	28116.3	1.0	4.9	0.1
35.9	3189.0	134115.1	75.7	28904.6	1.0	4.9	0.1
36.9	3157.8	137189.1	75.5	29692.8	1.0	4.9	0.1
37.9	3126.7	140230.9	75.4	30480.8	1.0	4.9	0.0
38.9	3095.8	143240.7	75.3	31268.9	1.0	4.9	0.0
39.9	3064.8	146218.5	75.1	32056.8	1.0	4.9	0.0
40.9	3034.0	149164.4	74.9	32844.7	1.0	4.9	0.0
41.9	3003.2	152078.3	74.8	33632.5	1.0	4.9	0.0
42.9	2972.4	154960.3	74.6	34420.3	1.0	4.9	0.0
43.9	2941.7	157810.5	74.5	35208.0	1.0	4.9	0.0
44.9	2911.1	160628.9	74.3	35995.7	1.0	4.9	0.0
45.9	2880.4	163415.5	74.1	36783.4	1.0	4.9	0.0
46.9	2849.9	166170.2	74.0	37571.0	1.0	4.9	0.0
47.9	2819.4	168893.3	73.8	38358.6	1.0	4.9	0.0
48.9	2788.9	171584.5	73.6	39146.2	1.0	4.9	0.0
49.9	2758.5	174244.1	73.4	39933.7	1.0	4.9	0.0
50.9	2728.1	176871.9	73.2	40721.3	1.0	4.9	0.0
51.9	2697.8	179468.0	73.0	41508.8	1.0	4.9	0.0
52.9	2667.5	182032.5	72.8	42296.3	1.0	4.9	0.0
53.9	2637.3	184565.3	72.6	43083.8	1.0	4.9	0.0
54.9	2607.1	187066.4	72.4	43871.2	1.0	4.9	0.0
55.9	2576.9	189535.9	72.2	44658.7	1.0	4.9	0.0
56.9	2546.8	191973.7	72.0	45446.1	1.0	4.9	0.0
57.9	2516.8	194380.0	71.8	46233.6	1.0	4.9	0.0
58.9	2486.8	196754.6	71.5	47021.0	1.0	4.9	0.0
59.9	2456.8	199097.6	71.3	47808.4	1.0	4.9	0.0
60.9	2426.9	201409.0	71.1	48595.8	1.0	4.9	0.0
61.9	2397.1	203688.8	70.8	49383.2	1.0	4.9	0.0
62.9	2367.3	205937.1	70.6	50170.6	1.0	4.9	0.0
63.9	2337.5	208153.8	70.3	50958.0	1.0	4.9	0.0
64.9	2307.8	210338.9	70.1	51745.4	1.0	4.9	0.0
65.9	2278.2	212492.5	69.8	52532.8	1.0	4.9	0.0
66.9	2248.6	214614.6	69.5	53320.2	1.0	4.9	0.0
67.9	2219.1	216705.1	69.2	54107.5	1.0	4.9	0.0
68.9	2189.7	218764.1	68.9	54894.9	1.0	4.9	0.0
69.9	2160.3	220791.5	68.6	55682.3	1.0	4.9	0.0
70.9	2131.0	222787.5	68.3	56469.6	1.0	4.9	0.0
71.9	2101.8	224751.9	68.0	57257.0	1.0	4.9	0.0
72.9	2072.6	226684.9	67.7	58044.3	1.0	4.9	0.0
73.9	2043.5	228586.3	67.3	58831.7	1.0	4.9	0.0
74.9	2014.5	230456.3	67.0	59619.0	1.0	4.9	0.0
75.9	1985.5	232294.8	66.6	60406.4	1.0	4.9	0.0
76.9	1956.7	234101.8	66.3	61193.7	1.0	4.9	0.0
77.9	1927.9	235877.4	65.9	61981.0	1.0	4.9	0.0
78.9	1899.2	237621.5	65.5	62768.4	1.0	4.9	0.0
79.9	1870.7	239334.1	65.1	63555.7	1.0	4.9	0.0
80.9	1842.2	241015.3	64.7	64343.1	1.0	4.9	0.0
81.9	1813.8	242665.0	64.3	65130.4	1.0	4.9	0.0

82.9	1785.5	244283.3	63.8	65917.7	1.0	4.9	0.0
83.9	1757.4	245870.2	63.4	66705.1	1.0	4.9	0.0
84.9	1729.3	247425.6	62.9	67492.4	1.0	4.9	0.0
85.9	1701.4	248949.6	62.4	68279.7	1.0	4.9	0.0
86.9	1673.6	250442.2	61.9	69067.1	1.0	4.9	0.0
87.9	1646.0	251903.4	61.4	69854.4	1.0	4.9	0.0
88.9	1618.5	253333.1	60.9	70641.7	1.0	4.9	0.0
89.9	1591.1	254731.5	60.3	71429.0	1.0	4.9	0.0
90.9	1563.9	256098.4	59.8	72216.4	1.0	4.9	0.0
91.9	1536.8	257434.0	59.2	73003.7	1.0	4.9	0.0
92.9	1510.0	258738.1	58.6	73791.0	1.0	4.9	0.0
93.9	1483.3	260010.9	57.9	74578.4	1.0	4.9	0.0
94.9	1456.8	261252.2	57.3	75365.7	1.0	4.9	0.0
95.9	1430.5	262462.2	56.6	76153.0	1.0	4.9	0.0
96.9	1404.4	263640.8	55.9	76940.3	1.0	4.9	0.0
97.9	1378.5	264788.0	55.2	77727.7	1.0	4.9	0.0
98.9	1352.9	265903.9	54.4	78515.0	1.0	4.9	0.0
99.9	1327.5	266988.4	53.6	79302.3	1.0	4.9	0.0
100.9	1302.4	268041.5	52.8	80089.6	1.0	4.9	0.0
101.9	1277.5	269063.3	52.0	80876.9	1.0	4.9	0.0
102.9	1253.0	270053.7	51.1	81664.3	1.0	4.9	0.0
103.9	1228.7	271012.7	50.2	82451.6	1.0	4.9	0.0
104.9	1204.8	271940.4	49.2	83238.9	1.0	4.9	0.0
105.9	1181.3	272836.7	48.2	84026.2	1.0	4.9	0.0
106.9	1158.1	273701.7	47.2	84813.6	1.0	4.9	0.0
107.9	1135.3	274535.3	46.1	85600.9	1.0	4.9	0.0
108.9	1112.9	275337.6	45.0	86388.2	1.0	4.9	0.0
109.9	1091.0	276108.6	43.8	87175.5	1.0	4.9	0.0
110.9	1069.6	276848.2	42.6	87962.8	1.0	4.9	0.0
111.9	1048.6	277556.5	41.3	88750.2	1.0	4.9	0.0
112.9	1028.2	278233.4	40.0	89537.5	1.0	4.9	0.0
113.9	1008.3	278879.1	38.7	90324.8	1.0	4.9	0.0
114.9	989.0	279493.3	37.2	91112.1	1.0	4.9	0.0
115.9	970.4	280076.3	35.8	91899.4	1.0	4.9	0.0
116.9	952.4	280627.9	34.2	92686.8	1.0	4.9	0.0
117.9	935.2	281148.2	32.7	93474.1	1.0	4.9	0.0
118.9	918.6	281637.2	31.0	94261.4	1.0	4.9	0.0
119.9	902.9	282094.8	29.3	95048.7	1.0	4.9	0.0
120.9	888.0	282521.2	27.5	95836.0	1.0	4.9	0.0
121.9	873.9	282916.2	25.7	96623.4	1.0	4.9	0.0
122.9	860.8	283279.9	23.8	97410.7	1.0	4.9	0.0
123.9	848.6	283612.2	21.9	98198.0	1.0	4.9	0.0
124.9	837.5	283913.3	19.9	98985.3	1.0	4.9	0.0
125.9	827.3	284183.1	17.9	99772.6	1.0	4.9	0.0
12..9	818.2	284421.5	15.8	100560.0	1.0	4.9	0.0
127.9	810.3	284628.6	13.7	101347.3	1.0	4.9	0.0
128.9	803.4	284804.4	11.5	102134.6	1.0	4.9	0.0
129.9	797.8	284948.9	9.3	102921.9	1.0	4.9	0.0
130.9	793.3	285062.1	7.1	103709.2	1.0	4.9	0.0
131.9	790.1	285143.9	4.8	104496.6	1.0	4.9	0.0
132.9	788.1	285194.5	2.5	105283.9	1.0	4.9	0.0
133.9	787.3	285213.7	0.3	106071.2	1.0	4.9	0.0
134.9	787.8	285201.6	-2.0	106858.5	1.0	4.9	0.0
135.9	789.5	285158.3	-4.3	107645.8	1.0	4.9	0.0
136.9	792.5	285083.6	-6.5	108433.2	1.0	4.9	0.0
137.9	796.7	284977.5	-8.8	109220.5	1.0	4.9	0.0
138.9	802.0	284840.2	-11.0	110007.8	1.0	4.9	0.0
139.9	808.6	284671.6	-13.2	110795.1	1.0	4.9	0.0
140.9	816.3	284471.6	-15.3	111582.4	1.0	4.9	0.0

141.9	825.1	284240.4	-17.4	112369.8	1.0	4.9	0.0
142.9	835.0	283977.8	-19.5	113157.1	1.0	4.9	0.0
143.9	846.0	283683.9	-21.5	113944.4	1.0	4.9	0.0
144.9	857.9	283358.7	-23.4	114731.7	1.0	4.9	0.0
145.9	870.9	283002.2	-25.3	115519.0	1.0	4.9	0.0
146.9	884.7	282614.3	-27.1	116306.4	1.0	4.9	0.0
147.9	899.4	282195.2	-28.9	117093.7	1.0	4.9	0.0
148.9	915.0	281744.7	-30.6	117881.0	1.0	4.9	0.0
149.9	931.3	281262.9	-32.3	118668.3	1.0	4.9	0.0
150.9	948.4	280749.8	-33.9	119455.6	1.0	4.9	0.0
151.9	966.2	280205.3	-35.4	120242.9	1.0	4.9	0.0
152.9	984.7	279629.5	-36.9	121030.3	1.0	4.9	0.0
153.9	1003.9	279022.4	-38.3	121817.6	1.0	4.9	0.0
154.9	1023.6	278384.0	-39.7	122604.9	1.0	4.9	0.0
155.9	1043.9	277714.2	-41.0	123392.2	1.0	4.9	0.0
156.9	1064.7	277013.1	-42.3	124179.5	1.0	4.9	0.0
157.9	1086.1	276280.6	-43.5	124966.8	1.0	4.9	0.0
158.9	1107.9	275516.9	-44.7	125754.2	1.0	4.9	0.0
159.9	1130.2	274721.7	-45.8	126541.5	1.0	4.9	0.0
160.9	1152.8	273895.3	-46.9	127328.8	1.0	4.9	0.0
161.9	1175.9	273037.5	-48.0	128116.1	1.0	4.9	0.0
162.9	1199.4	272148.3	-49.0	128903.4	1.0	4.9	0.0
163.9	1223.2	271227.8	-49.9	129690.7	1.0	4.9	0.0
164.9	1247.4	270276.0	-50.9	130478.1	1.0	4.9	0.0
165.9	1271.9	269292.7	-51.8	131265.4	1.0	4.9	0.0
166.9	1296.6	268278.2	-52.6	132052.7	1.0	4.9	0.0
167.9	1321.7	267232.2	-53.4	132840.0	1.0	4.9	0.0
168.9	1347.0	266154.9	-54.2	133627.3	1.0	4.9	0.0
169.9	1372.6	265046.3	-55.0	134414.6	1.0	4.9	0.0
170.9	1398.4	263906.2	-55.7	135202.0	1.0	4.9	0.0
171.9	1424.5	262734.8	-56.4	135989.3	1.0	4.9	0.0
172.9	1450.7	261532.0	-57.1	136776.6	1.0	4.9	0.0
173.9	1477.2	260297.8	-57.8	137563.9	1.0	4.9	0.0
174.9	1503.8	259032.3	-58.4	138351.2	1.0	4.9	0.0
175.9	1530.7	257735.3	-59.0	139138.5	1.0	4.9	0.0
176.9	1557.7	256407.0	-59.6	139925.8	1.0	4.9	0.0
177.9	1584.8	255047.3	-60.2	140713.1	1.0	4.9	0.0
178.9	1612.2	253656.1	-60.8	141500.5	1.0	4.9	0.0
179.9	1639.6	252233.6	-61.3	142287.8	1.0	4.9	0.0
180.9	1667.3	250779.6	-61.8	143075.1	1.0	4.9	0.0
181.9	1695.0	249294.3	-62.3	143862.4	1.0	4.9	0.0
182.9	1722.9	247777.5	-62.8	144649.7	1.0	4.9	0.0
183.9	1750.9	246229.3	-63.3	145437.0	1.0	4.9	0.0
184.9	1779.0	244649.7	-63.7	146224.3	1.0	4.9	0.0
185.9	1807.3	243038.6	-64.2	147011.6	1.0	4.9	0.0
186.9	1835.6	241396.1	-64.6	147798.9	1.0	4.9	0.0
187.9	1864.1	239722.2	-65.0	148586.2	1.0	4.9	0.0
188.9	1892.6	238016.8	-65.4	149373.5	1.0	4.9	0.0
189.9	1921.3	236280.0	-65.8	150160.8	1.0	4.9	0.0
190.9	1950.0	234511.7	-66.2	150948.1	1.0	4.9	0.0
191.9	1978.8	232712.0	-66.6	151735.4	1.0	4.9	0.0
192.9	2007.7	230880.8	-66.9	152522.7	1.0	4.9	0.0
193.9	2036.7	229018.1	-67.3	153310.0	1.0	4.9	0.0
194.9	2065.8	227124.0	-67.6	154097.3	1.0	4.9	0.0
195.9	2094.9	225198.4	-67.9	154884.6	1.0	4.9	0.0
196.9	2124.1	223241.3	-68.2	155671.8	1.0	4.9	0.0
197.9	2153.4	221252.7	-68.6	156459.1	1.0	4.9	0.0
198.9	2182.8	219232.6	-68.9	157246.4	1.0	4.9	0.0
199.9	2212.2	217181.0	-69.2	158033.7	1.0	4.9	0.0

200.9	2241.6	215097.9	-69.4	158821.0	1.0	4.9	0.0
201.9	2271.2	212983.3	-69.7	159608.2	1.0	4.9	0.0
202.9	2300.8	210837.2	-70.0	160395.5	1.0	4.9	0.0
203.9	2330.4	208659.6	-70.3	161182.7	1.0	4.9	0.0
204.9	2360.1	206450.4	-70.5	161970.0	1.0	4.9	0.0
205.9	2389.8	204209.8	-70.8	162757.2	1.0	4.9	0.0
206.9	2419.6	201937.5	-71.0	163544.5	1.0	4.9	0.0
207.9	2449.5	199633.8	-71.3	164331.7	1.0	4.9	0.0
208.9	2479.4	197298.5	-71.5	165118.9	1.0	4.9	0.0
209.9	2509.3	194931.6	-71.7	165906.1	1.0	4.9	0.0
210.9	2539.3	192533.2	-71.9	166693.3	1.0	4.9	0.0
211.9	2569.3	190103.3	-72.2	167480.5	1.0	4.9	0.0
212.9	2599.4	187641.8	-72.4	168267.7	1.0	4.9	0.0
213.9	2629.5	185148.7	-72.6	169054.9	1.0	4.9	0.0
214.9	2659.6	182624.0	-72.8	169842.0	1.0	4.9	0.0
215.9	2689.8	180067.8	-73.0	170629.2	1.0	4.9	0.0
216.9	2720.0	177480.0	-73.2	171416.3	1.0	4.9	0.0
217.9	2750.2	174860.7	-73.4	172203.4	1.0	4.9	0.0
218.9	2780.4	172209.7	-73.6	172990.5	1.0	4.9	0.0
219.9	2810.7	169527.2	-73.7	173777.6	1.0	4.9	0.0
220.9	2841.1	166813.2	-73.9	174564.6	1.0	4.9	0.0
221.9	2871.4	164067.5	-74.1	175351.6	1.0	4.9	0.0
222.9	2901.8	161290.3	-74.3	176138.6	1.0	4.9	0.0
223.9	2932.1	158481.5	-74.4	176925.6	1.0	4.9	0.0
224.9	2962.5	155641.1	-74.6	177712.5	1.0	4.9	0.0
225.9	2993.0	152769.2	-74.8	178499.3	1.0	4.9	0.0
226.9	3023.4	149865.8	-74.9	179286.2	1.0	4.9	0.0
227.9	3053.8	146930.8	-75.1	180072.9	1.0	4.9	0.0
228.9	3084.2	143964.4	-75.2	180859.7	1.0	4.9	0.0
229.9	3114.7	140966.4	-75.4	181646.3	1.0	4.9	0.0
230.9	3145.1	137937.0	-75.5	182432.9	1.0	4.9	0.1
231.9	3175.5	134876.1	-75.7	183219.4	1.0	4.9	0.1
232.9	3205.8	131783.9	-75.8	184005.8	1.0	4.9	0.1
233.9	3236.2	128660.4	-75.9	184792.1	1.0	4.9	0.1
234.9	3266.4	125505.5	-76.1	185578.2	1.0	4.9	0.1
235.9	3296.7	122319.5	-76.2	186364.2	1.0	4.9	0.1
236.9	3326.8	119102.4	-76.3	187150.1	1.0	4.9	0.1
237.9	3356.8	115854.2	-76.5	187935.7	1.0	4.9	0.1
238.9	3386.7	112575.2	-76.6	188721.2	1.0	4.9	0.2
239.9	3416.5	109265.4	-76.7	189506.3	0.9	4.9	0.2
240.9	3446.0	105925.1	-76.8	190291.2	0.9	4.9	0.2
241.9	3475.4	102554.4	-77.0	191075.7	0.9	5.0	0.3
242.9	3504.4	99153.8	-77.1	191859.7	0.9	5.0	0.3
243.9	3533.0	95723.4	-77.2	192643.3	0.9	5.0	0.4
244.9	3561.2	92263.7	-77.3	193426.3	0.9	5.0	0.5
245.9	3588.8	88775.3	-77.4	194208.6	0.9	5.0	0.6
246.9	3615.8	85258.7	-77.5	194990.1	0.9	5.0	0.7
247.9	3641.9	81714.7	-77.6	195770.5	0.8	5.0	0.9
248.9	3666.9	78144.3	-77.7	196549.8	0.8	5.0	1.0
249.9	3690.8	74548.4	-77.8	197327.6	0.8	5.0	1.2
250.9	3713.3	70928.6	-78.0	198103.7	0.7	5.0	1.5
251.9	3733.9	67286.2	-78.1	198877.8	0.6	5.0	1.8
252.9	3752.5	63623.2	-78.2	199649.6	0.6	5.0	2.2
253.9	3768.6	59941.8	-78.3	200418.4	0.5	5.0	2.6
254.9	3781.6	56244.9	-78.4	201183.9	0.4	5.0	3.1
255.9	3790.9	52535.7	-78.4	201945.2	0.3	5.0	3.7
256.9	3796.0	48818.0	-78.5	202701.8	0.2	5.0	4.5
257.9	3795.9	45096.6	-78.6	203452.6	0.2	5.0	5.3
258.9	3789.7	41377.0	-78.7	204196.7	0.4	5.0	6.4

259.9	3776.4	37665.6	-78.8	204932.7	0.6	5.0	7.6
260.9	3755.2	33969.9	-78.9	205659.3	0.8	5.0	8.8
261.9	3726.2	30297.6	-79.0	206375.0	1.0	5.0	10.0
262.9	3689.2	26656.6	-79.1	207078.5	1.3	5.0	11.3
263.9	3643.7	23054.8	-79.2	207768.2	1.6	5.0	12.6
264.9	3589.5	19500.9	-79.3	208442.7	1.8	5.0	14.0
265.9	3526.5	16003.4	-79.4	209100.5	2.1	5.0	15.4
266.9	3454.7	12571.2	-79.5	209740.0	2.4	5.0	16.7
267.9	3374.2	9212.8	-79.6	210359.9	2.6	5.0	18.1
268.9	3285.6	5936.5	-79.7	210958.8	2.9	5.0	19.3
269.9	3189.3	2750.2	-79.8	211535.5	3.1	5.0	20.4
270.8	3097.8	-0.0	-79.9	212028.4	3.3	5.0	21.4

RUN 1C

INITIAL DATA

Z(0)= 0.   AL= 1.4834E 00   V(0)= 10.0000E-02
ISP(0)= 2.2623E 02   K(T)= 6.4800E-01   D(B)= 8.3333E-02
D(M)= 2.5000E-01   M(B)= 1.5540E-01   M(0)= 8.7743E-01
M(P)= 5.2278E-01   MR= 2.7514E-01

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
0.	0.1	0.	85.0	0.	67.0	28.2	0.0
0.1	219.0	10.9	84.8	1.0	69.1	27.3	1.0
0.2	445.0	43.9	84.8	4.0	71.4	26.5	4.1
0.3	678.2	99.7	84.7	9.1	73.7	25.6	9.5
0.4	919.0	179.2	84.7	16.5	76.0	24.7	17.5
0.5	1167.4	283.0	84.7	26.1	78.4	23.8	28.1
0.6	1423.8	411.9	84.7	38.2	80.9	22.9	41.7
0.7	1688.3	566.8	84.7	52.6	83.5	22.0	58.3
0.8	1961.2	748.4	84.7	69.6	86.1	21.1	78.3
0.9	2242.6	957.6	84.6	89.2	88.8	20.3	101.7
1.0	2532.6	1195.2	84.6	111.5	91.5	19.4	128.9
1.1	2831.6	1462.2	84.6	136.6	94.3	18.5	159.8
1.2	3139.7	1759.4	84.6	164.6	97.2	17.6	194.8
1.3	3457.1	2087.7	84.6	195.5	100.1	16.7	233.8
1.4	3784.0	2448.1	84.6	229.5	103.1	15.8	277.2
1.5	4120.5	2841.5	84.6	266.6	106.1	14.9	324.8
1.6	4467.0	3268.9	84.6	306.9	109.3	14.1	376.9
1.7	4823.7	3731.2	84.6	350.6	112.5	13.2	433.5
1.8	5190.9	4229.7	84.6	397.7	115.8	12.3	494.5
1.9	5568.9	4765.2	84.6	448.4	119.2	11.4	560.0
1.9	5569.1	4765.4	84.6	448.4	119.2	11.4	560.0
1.9	5569.1	4765.4	84.6	448.4	10.6	5.0	48.2
2.9	5265.9	10152.6	84.6	959.8	8.3	5.0	36.8
3.9	5024.9	15270.4	84.5	1448.5	6.7	5.0	28.6
4.9	4829.3	20171.6	84.5	1919.6	5.5	5.0	22.6
5.9	4667.6	24895.6	84.5	2376.7	4.6	5.0	18.0
6.9	4532.0	29471.8	84.4	2822.6	3.9	5.0	14.4
7.9	4416.8	33923.3	84.4	3259.4	3.3	5.0	11.6
8.9	4317.8	38268.2	84.3	3688.8	2.8	5.0	9.2
9.9	4233.1	42521.6	84.3	4112.4	2.4	5.0	7.3
10.9	4159.4	46696.1	84.2	4531.3	2.1	5.0	5.8
11.9	4094.2	50801.3	84.2	4946.4	1.9	5.0	4.6
12.9	4035.7	54844.9	84.2	5358.6	1.7	5.0	3.7
13.9	3982.3	58832.5	84.1	5768.2	1.6	5.0	3.0
14.9	3933.1	62768.8	84.1	6175.9	1.5	5.0	2.4
15.9	3887.1	66657.5	84.0	6582.0	1.4	5.0	2.0
16.9	3843.7	70501.5	84.0	6986.7	1.3	5.0	1.6
17.9	3802.5	74303.1	83.9	7390.4	1.3	5.0	1.3
18.9	3763.0	78064.2	83.9	7793.1	1.2	5.0	1.1
19.9	3724.9	81786.4	83.8	8195.0	1.2	5.0	0.9
20.9	3687.9	85471.0	83.8	8596.4	1.1	5.0	0.7
21.9	3651.9	89118.9	83.7	8997.2	1.1	5.0	0.6
22.9	3616.7	92731.1	83.6	9397.6	1.1	5.0	0.5

23.9	3582.1	96308.1	83.6	9797.7	1.1	5.0	0.4
24.9	3548.1	99850.7	83.5	10197.4	1.1	5.0	0.3
25.9	3514.4	103359.3	83.5	10596.9	1.0	5.0	0.3
26.9	3481.1	106834.1	83.4	10996.2	1.0	4.9	0.2
27.9	3448.1	110275.6	83.4	11395.4	1.0	4.9	0.2
28.9	3415.3	113684.0	83.3	11794.3	1.0	4.9	0.2
29.9	3382.6	117059.4	83.2	12193.2	1.0	4.9	0.1
30.9	3350.2	120402.1	83.2	12591.9	1.0	4.9	0.1
31.9	3317.9	123712.3	83.1	12990.6	1.0	4.9	0.1
32.9	3285.7	126989.9	83.0	13389.1	1.0	4.9	0.1
33.9	3253.7	130235.3	83.0	13787.6	1.0	4.9	0.1
34.9	3221.7	133448.3	82.9	14186.0	1.0	4.9	0.1
35.9	3189.8	136629.2	82.8	14584.4	1.0	4.9	0.1
36.9	3157.9	139777.9	82.8	14982.8	1.0	4.9	0.0
37.9	3126.1	142894.6	82.7	15381.1	1.0	4.9	0.0
38.9	3094.4	145979.3	82.6	15779.3	1.0	4.9	0.0
39.9	3062.7	149032.0	82.5	16177.6	1.0	4.9	0.0
40.9	3031.1	152052.8	82.5	16575.8	1.0	4.9	0.0
41.9	2999.5	155041.7	82.4	16973.9	1.0	4.9	0.0
42.9	2967.9	157998.7	82.3	17372.1	1.0	4.9	0.0
43.9	2936.4	160923.9	82.2	17770.2	1.0	4.9	0.0
44.9	2904.9	163817.3	82.1	18168.4	1.0	4.9	0.0
45.9	2873.4	166678.9	82.0	18566.5	1.0	4.9	0.0
46.9	2842.0	169508.7	81.9	18964.6	1.0	4.9	0.0
47.9	2810.6	172306.8	81.9	19362.6	1.0	4.9	0.0
48.9	2779.2	175073.2	81.8	19760.7	1.0	4.9	0.0
49.9	2747.8	177807.9	81.7	20158.8	1.0	4.9	0.0
50.9	2716.4	180510.8	81.6	20556.8	1.0	4.9	0.0
51.9	2685.1	183182.1	81.5	20954.9	1.0	4.9	0.0
52.9	2653.8	185821.8	81.4	21352.9	1.0	4.9	0.0
53.9	2622.5	188429.7	81.3	21750.9	1.0	4.9	0.0
54.9	2591.3	191006.0	81.2	22148.9	1.0	4.9	0.0
55.9	2560.0	193550.7	81.1	22547.0	1.0	4.9	0.0
56.9	2528.8	196063.8	80.9	22945.0	1.0	4.9	0.0
57.9	2497.6	198545.3	80.8	23343.0	1.0	4.9	0.0
58.9	2466.4	200995.2	80.7	23741.0	1.0	4.9	0.0
59.9	2435.2	203413.5	80.6	24139.0	1.0	4.9	0.0
60.9	2404.1	205800.2	80.5	24537.0	1.0	4.9	0.0
61.9	2373.0	208155.3	80.3	24935.0	1.0	4.9	0.0
62.9	2341.9	210478.9	80.2	25332.9	1.0	4.9	0.0
63.9	2310.8	212771.0	80.1	25730.9	1.0	4.9	0.0
64.9	2279.7	215031.5	79.9	26128.9	1.0	4.9	0.0
65.9	2248.7	217260.4	79.8	26526.9	1.0	4.9	0.0
66.9	2217.7	219457.9	79.7	26924.9	1.0	4.9	0.0
67.9	2186.7	221623.8	79.5	27322.8	1.0	4.9	0.0
68.9	2155.7	223758.2	79.4	27720.8	1.0	4.9	0.0
69.9	2124.8	225861.1	79.2	28118.8	1.0	4.9	0.0
70.9	2093.8	227932.5	79.0	28516.8	1.0	4.9	0.0
71.9	2062.9	229972.4	78.9	28914.7	1.0	4.9	0.0
72.9	2032.1	231980.9	78.7	29312.7	1.0	4.9	0.0
73.9	2001.2	233957.9	78.5	29710.7	1.0	4.9	0.0
74.9	1970.4	235903.4	78.3	30108.6	1.0	4.9	0.0
75.9	1939.6	237817.4	78.2	30506.6	1.0	4.9	0.0
76.9	1908.8	239700.0	78.0	30904.6	1.0	4.9	0.0
77.9	1878.1	241551.1	77.8	31302.5	1.0	4.9	0.0
78.9	1847.3	243370.8	77.6	31700.5	1.0	4.9	0.0
79.9	1816.7	245159.0	77.3	32098.5	1.0	4.9	0.0
80.9	1786.0	246915.9	77.1	32496.4	1.0	4.9	0.0
81.9	1755.4	248641.2	76.9	32894.4	1.0	4.9	0.0

82.9	1724.8	250335.2	76.7	33292.4	1.0	4.9	0.0
83.9	1694.2	251997.8	76.4	33690.3	1.0	4.9	0.0
84.9	1663.7	253628.9	76.2	34088.3	1.0	4.9	0.0
85.9	1633.3	255228.6	75.9	34486.3	1.0	4.9	0.0
86.9	1602.8	256796.9	75.6	34884.2	1.0	4.9	0.0
87.9	1572.4	258333.9	75.3	35282.2	1.0	4.9	0.0
88.9	1542.1	259839.4	75.0	35680.1	1.0	4.9	0.0
89.9	1511.8	261313.6	74.7	36078.1	1.0	4.9	0.0
90.9	1481.5	262756.3	74.4	36476.1	1.0	4.9	0.0
91.9	1451.3	264167.7	74.1	36874.0	1.0	4.9	0.0
92.9	1421.2	265547.7	73.7	37272.0	1.0	4.9	0.0
93.9	1391.1	266896.4	73.4	37670.0	1.0	4.9	0.0
94.9	1361.1	268213.6	73.0	38067.9	1.0	4.9	0.0
95.9	1331.1	269499.5	72.6	38465.9	1.0	4.9	0.0
96.9	1301.2	270754.1	72.2	38863.8	1.0	4.9	0.0
97.9	1271.4	271977.3	71.8	39261.8	1.0	4.9	0.0
98.9	1241.7	273169.1	71.3	39659.8	1.0	4.9	0.0
99.9	1212.0	274329.6	70.8	40057.7	1.0	4.9	0.0
100.9	1182.5	275458.8	70.3	40455.7	1.0	4.9	0.0
101.9	1153.0	276556.6	69.8	40853.6	1.0	4.9	0.0
102.9	1123.6	277623.1	69.3	41251.6	1.0	4.9	0.0
103.9	1094.4	278658.2	68.7	41649.5	1.0	4.9	0.0
104.9	1065.3	279662.0	68.1	42047.5	1.0	4.9	0.0
105.9	1036.3	280634.5	67.4	42445.5	1.0	4.9	0.0
106.9	1007.4	281575.6	66.7	42843.4	1.0	4.9	0.0
107.9	978.7	282485.5	66.0	43241.4	1.0	4.9	0.0
108.9	950.2	283364.0	65.2	43639.3	1.0	4.9	0.0
109.9	921.9	284211.2	64.4	44037.3	1.0	4.9	0.0
110.9	893.7	285027.1	63.6	44435.3	1.0	4.9	0.0
111.9	865.8	285811.6	62.6	44833.2	1.0	4.9	0.0
112.9	838.1	286564.9	61.7	45231.2	1.0	4.9	0.0
113.9	810.7	287286.8	60.6	45629.1	1.0	4.9	0.0
114.9	783.6	287977.5	59.5	46027.1	1.0	4.9	0.0
115.9	756.8	288636.8	58.3	46425.1	1.0	4.9	0.0
116.9	730.3	289264.9	57.0	46823.0	1.0	4.9	0.0
117.9	704.3	289861.6	55.6	47221.0	1.0	4.9	0.0
118.9	678.7	290427.0	54.1	47618.9	1.0	4.9	0.0
119.9	653.6	290961.2	52.5	48016.9	1.0	4.9	0.0
120.9	629.1	291464.0	50.8	48414.9	1.0	4.9	0.0
121.9	605.2	291935.6	48.9	48812.8	1.0	4.9	0.0
122.9	582.0	292375.8	46.9	49210.8	1.0	4.9	0.0
123.9	559.5	292784.8	44.7	49608.7	1.0	4.9	0.0
124.9	538.0	293162.5	42.3	50006.7	1.0	4.9	0.0
125.9	517.5	293508.9	39.7	50404.6	1.0	4.9	0.0
126.9	498.0	293824.0	37.0	50802.6	1.0	4.9	0.0
127.9	479.9	294107.8	34.0	51200.6	1.0	4.9	0.0
128.9	463.1	294360.4	30.8	51598.5	1.0	4.9	0.0
129.9	447.9	294581.6	27.3	51996.5	1.0	4.9	0.0
130.9	434.5	294771.6	23.7	52394.4	1.0	4.9	0.0
131.9	422.9	294930.3	19.8	52792.4	1.0	4.9	0.0
132.9	413.4	295057.7	15.7	53190.4	1.0	4.9	0.0
133.9	406.0	295153.8	11.4	53588.3	1.0	4.9	0.0
134.9	401.0	295218.6	7.0	53986.3	1.0	4.9	0.0
135.9	398.4	295252.2	2.6	54384.2	1.0	4.9	0.0
136.9	398.2	295254.4	-1.9	54782.2	1.0	4.9	0.0
137.9	400.5	295225.4	-6.4	55180.1	1.0	4.9	0.0
138.9	405.1	295165.1	-10.8	55578.1	1.0	4.9	0.0
139.9	412.1	295073.5	-15.1	55976.1	1.0	4.9	0.0
140.9	421.4	294950.7	-19.2	56374.0	1.0	4.9	0.0

141.9	432.7	294796.5	-23.1	56772.0	1.0	4.9	0.0
142.9	445.9	294611.1	-26.8	57169.9	1.0	4.9	0.0
143.9	460.8	294394.4	-30.3	57567.9	1.0	4.9	0.0
144.9	477.4	294146.4	-33.5	57965.9	1.0	4.9	0.0
145.9	495.3	293867.1	-36.5	58363.8	1.0	4.9	0.0
146.9	514.6	293556.6	-39.3	58761.8	1.0	4.9	0.0
147.9	535.0	293214.7	-41.9	59159.7	1.0	4.9	0.0
148.9	556.3	292841.6	-44.3	59557.7	1.0	4.9	0.0
149.9	578.6	292437.2	-46.5	59955.7	1.0	4.9	0.0
150.9	601.7	292001.4	-48.6	60353.6	1.0	4.9	0.0
151.9	625.6	291534.4	-50.5	60751.6	1.0	4.9	0.0
152.9	650.0	291036.1	-52.2	61149.5	1.0	4.9	0.0
153.9	675.0	290506.5	-53.9	61547.5	1.0	4.9	0.0
154.9	700.6	289945.6	-55.4	61945.4	1.0	4.9	0.0
155.9	726.5	289353.4	-56.8	62343.4	1.0	4.9	0.0
156.9	752.9	288729.9	-58.1	62741.4	1.0	4.9	0.0
157.9	779.7	288075.1	-59.3	63139.3	1.0	4.5	0.0
158.9	806.7	287389.0	-60.4	63537.3	1.0	4.9	0.0
159.9	834.1	286671.6	-61.5	63935.2	1.0	4.9	0.0
160.9	861.8	285922.9	-62.5	64333.2	1.0	4.9	0.0
161.9	889.6	285142.9	-63.4	64731.2	1.0	4.9	0.0
162.9	917.8	284331.6	-64.3	65129.1	1.0	4.9	0.0
163.9	946.1	283488.9	-65.1	65527.1	1.0	4.9	0.0
164.9	974.6	282615.0	-65.9	65925.0	1.0	4.9	0.0
165.9	1003.2	281709.7	-66.6	66323.0	1.0	4.9	0.0
166.9	1032.1	280773.1	-67.3	66720.9	1.0	4.9	0.0
167.9	1061.0	279805.1	-68.0	67118.9	1.0	4.9	0.0
168.9	1090.2	278805.9	-68.6	67516.9	1.0	4.9	0.0
169.9	1119.4	277775.3	-69.2	67914.8	1.0	4.9	0.0
170.9	1148.7	276713.4	-69.7	68312.8	1.0	4.9	0.0
171.9	1178.2	275620.1	-70.3	68710.7	1.0	4.9	0.0
172.9	1207.7	274495.5	-70.8	69108.7	1.0	4.9	0.0
173.9	1237.4	273339.6	-71.2	69506.7	1.0	4.9	0.0
174.9	1267.1	272152.3	-71.7	69904.6	1.0	4.9	0.0
175.9	1296.9	270933.6	-72.1	70302.6	1.0	4.9	0.0
176.9	1326.8	269683.7	-72.5	70700.5	1.0	4.9	0.0
177.9	1356.7	268402.3	-72.9	71098.5	1.0	4.9	0.0
178.9	1386.7	267089.6	-73.3	71496.4	1.0	4.9	0.0
179.9	1416.8	265745.5	-73.7	71894.4	1.0	4.9	0.0
180.9	1446.9	264370.1	-74.0	72292.4	1.0	4.9	0.0
181.9	1477.1	262963.2	-74.4	72690.3	1.0	4.9	0.0
182.9	1507.4	261525.1	-74.7	73088.3	1.0	4.9	0.0
183.9	1537.7	260055.5	-75.0	73486.2	1.0	4.9	0.0
184.9	1568.0	258554.5	-75.3	73884.2	1.0	4.9	0.0
185.9	1598.4	257022.2	-75.6	74282.1	1.0	4.9	0.0
186.9	1628.8	255458.4	-75.9	74680.1	1.0	4.9	0.0
187.9	1659.3	253863.3	-76.1	75078.0	1.0	4.9	0.0
188.9	1689.8	252236.7	-76.4	75476.0	1.0	4.9	0.0
189.9	1720.3	250578.8	-76.6	75874.0	1.0	4.9	0.0
190.9	1750.9	248889.4	-76.9	76271.9	1.0	4.9	0.0
191.9	1781.5	247168.6	-77.1	76669.9	1.0	4.9	0.0
192.9	1812.2	245416.4	-77.3	77067.8	1.0	4.9	0.0
193.9	1842.8	243632.8	-77.5	77465.8	1.0	4.9	0.0
194.9	1873.5	241817.7	-77.7	77863.7	1.0	4.9	0.0
195.9	1904.3	239971.2	-77.9	78261.7	1.0	4.9	0.0
196.9	1935.0	238093.2	-78.1	78659.6	1.0	4.9	0.0
197.9	1965.8	236183.8	-78.3	79057.6	1.0	4.9	0.0
198.9	1996.6	234243.0	-78.5	79455.5	1.0	4.9	0.0
199.9	2027.5	232270.7	-78.7	79853.5	1.0	4.9	0.0

200.9	2058.3	230266.9	-78.9	80251.4	1.0	4.9	0.0
201.9	2089.2	228231.6	-79.0	80649.4	1...	4.9	0.0
202.9	2120.1	226164.9	-79.2	81047.3	1.0	4.9	0.0
203.9	2151.1	224066.7	-79.3	81445.2	1.0	4.9	0.0
204.9	2182.0	221937.0	-79.5	81843.2	1.0	4.9	0.0
205.9	2213.0	219775.8	-79.6	82241.1	1.0	4.9	0.0
206.9	2244.0	217583.2	-79.8	82639.1	1.0	4.9	0.0
207.9	2275.0	215359.0	-79.9	83037.0	1.0	4.9	0.0
208.9	2306.0	213103.3	-80.1	83434.9	1.0	4.9	0.0
209.9	2337.1	210816.1	-80.2	83832.9	1.0	4.9	0.0
210.9	2368.2	208497.4	-80.3	84230.8	1.0	4.9	0.0
211.9	2399.2	206147.1	-80.5	84628.7	1.0	4.9	0.0
212.9	2430.3	203765.4	-80.6	85026.7	1.0	4.9	0.0
213.9	2461.4	201352.1	-80.7	85424.6	1.0	4.9	0.0
214.9	2492.6	198907.2	-80.8	85822.5	1.0	4.9	0.0
215.9	2523.7	196430.8	-80.9	86220.4	1.0	4.9	0.0
216.9	2554.9	193922.9	-81.0	86618.3	1.0	4.9	0.0
217.9	2586.1	191383.4	-81.1	87016.2	1.0	4.9	0.0
218.9	2617.2	188812.4	-81.3	87414.1	1.0	4.9	0.0
219.9	2648.4	186209.8	-81.4	87812.0	1.0	4.9	0.0
220.9	2679.7	183575.6	-81.5	88209.9	1.0	4.9	0.0
221.9	2710.9	180909.9	-81.6	88607.8	1.0	4.9	0.0
222.9	2742.1	178212.6	-81.7	89005.6	1.0	4.9	0.0
223.9	2773.3	175483.7	-81.8	89403.5	1.0	4.9	0.0
224.9	2804.6	172723.3	-81.8	89801.3	1.0	4.9	0.0
225.9	2835.8	169931.2	-81.9	90199.2	1.0	4.9	0.0
226.9	2867.1	167107.7	-82.0	90597.0	1.0	4.9	0.0
227.9	2898.4	164252.5	-82.1	90994.8	1.0	4.9	0.0
228.9	2929.6	161365.8	-82.2	91392.6	1.0	4.9	0.0
229.9	2960.9	158447.5	-82.3	91790.4	1.0	4.9	0.0
230.9	2992.2	155497.7	-82.4	92188.2	1.0	4.9	0.0
231.9	3023.4	152516.3	-82.4	92585.9	1.0	4.9	0.0
232.9	3054.7	149503.4	-82.5	92983.6	1.0	4.9	0.0
233.9	3085.9	146459.0	-82.6	93381.3	1.0	4.9	0.0
234.9	3117.1	143383.1	-82.7	93779.0	1.0	4.9	0.0
235.9	3148.3	140275.7	-82.7	94176.6	1.0	4.9	0.0
236.9	3179.5	137136.9	-82.8	94574.2	1.0	4.9	0.1
237.9	3210.6	133966.6	-82.9	94971.7	1.0	4.9	0.1
238.9	3241.7	130765.1	-83.0	95369.2	1.0	4.9	0.1
239.9	3272.7	127532.2	-83.0	95766.7	1.0	4.9	0.1
240.9	3303.7	124268.1	-83.1	96164.0	1.0	4.9	0.1
241.9	3334.6	120972.8	-83.2	96561.3	1.0	4.9	0.1
242.9	3365.3	117646.5	-83.2	96958.5	1.0	4.9	0.1
243.9	3395.9	114289.3	-83.3	97355.6	1.0	4.9	0.2
244.9	3426.4	110901.2	-83.3	97752.6	1.0	4.9	0.2
245.9	3456.7	107482.6	-83.4	98149.4	0.9	4.9	0.2
246.9	3486.7	104033.6	-83.5	98546.1	0.9	5.0	0.3
247.9	3516.5	100554.5	-83.5	98942.5	0.9	5.0	0.3
248.9	3545.9	97045.6	-83.6	99338.7	0.9	5.0	0.4
249.9	3574.8	93507.3	-83.6	99734.7	0.9	5.0	0.5
250.9	3603.2	89940.2	-83.7	100130.3	0.9	5.0	0.6
251.9	3630.9	86344.7	-83.8	100525.5	0.9	5.0	0.7
252.9	3657.8	82721.8	-83.8	100920.2	0.8	5.0	0.8
253.9	3683.6	79072.2	-83.9	101314.4	0.8	5.0	1.0
254.9	3708.3	75397.2	-83.9	101707.8	0.8	5.0	1.2
255.9	3731.5	71697.9	-84.0	102100.5	0.7	5.0	1.5
256.9	3753.0	67976.1	-84.0	102492.1	0.6	5.0	1.8
257.9	3772.3	64233.5	-84.1	102882.6	0.6	5.0	2.1
258.9	3789.2	60472.6	-84.1	103271.6	0.5	5.0	2.6

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24.9	3669.6	98564.9	70.9	30760.4	1.1	5.0	0.4
25.9	3637.3	102014.8	70.7	31962.8	1.1	5.0	0.3
26.9	3605.4	105430.8	70.5	33164.6	1.0	4.9	0.3
27.9	3573.8	108813.4	70.4	34365.8	1.0	4.9	0.2
28.9	3542.4	112162.8	70.2	35566.5	1.0	4.9	0.2
29.9	3511.4	115479.2	70.0	36766.8	1.0	4.9	0.2
30.9	3480.5	118762.7	59.8	37966.7	1.0	4.9	0.1
31.9	3449.9	122013.6	69.7	39166.3	1.0	4.9	0.1
32.9	3419.4	125232.0	69.5	40365.7	1.0	4.9	0.1
33.9	3389.0	128418.0	69.3	41564.8	1.0	4.9	0.1
34.9	3358.8	131571.7	69.1	42763.7	1.0	4.9	0.1
35.9	3328.7	134693.1	68.9	43962.5	1.0	4.9	0.1
36.9	3298.7	137782.4	68.7	45161.1	1.0	4.9	0.1
37.9	3268.8	140839.6	68.5	46359.5	1.0	4.9	0.0
38.9	3239.0	143864.7	68.3	47557.9	1.0	4.9	0.0
39.9	3209.2	146857.9	68.1	48756.1	1.0	4.9	0.0
40.9	3179.6	149819.1	67.9	49954.3	1.0	4.9	0.0
41.9	3150.1	152748.4	67.6	51152.3	1.0	4.9	0.0
42.9	3120.6	155645.8	67.4	52350.3	1.0	4.9	0.0
43.9	3091.2	158511.3	67.2	53548.3	1.0	4.9	0.0
44.9	3061.9	161345.1	67.0	54746.1	1.0	4.9	0.0
45.9	3032.6	164147.0	66.7	55944.0	1.0	4.9	0.0
46.9	3003.4	166917.1	66.5	57141.8	1.0	4.9	0.0
47.9	2974.3	169655.5	66.3	58339.5	1.0	4.9	0.0
48.9	2945.3	172362.2	66.0	59537.2	1.0	4.9	0.0
49.9	2916.3	175037.1	65.8	60734.9	1.0	4.9	0.0
50.9	2887.4	177680.3	65.5	61932.5	1.0	4.9	0.0
51.9	2858.6	180291.8	65.2	63130.1	1.0	4.9	0.0
52.9	2829.9	182871.6	65.0	64327.7	1.0	4.9	0.0
53.9	2801.2	185419.8	64.7	65525.3	1.0	4.9	0.0
54.9	2772.6	187936.3	64.4	66722.8	1.0	4.9	0.0
55.9	2744.1	190421.2	64.1	67920.3	1.0	4.9	0.0
56.9	2715.7	192874.4	63.8	69117.8	1.0	4.9	0.0
57.9	2687.4	195296.0	63.5	70315.3	1.0	4.9	0.0
58.9	2659.1	197686.0	63.2	71512.8	1.0	4.9	0.0
59.9	2630.9	200044.4	62.9	72710.2	1.0	4.9	0.0
60.9	2602.8	202371.3	62.6	73907.7	1.0	4.9	0.0
61.9	2574.8	204666.5	62.3	75105.1	1.0	4.9	0.0
62.9	2546.9	206930.2	62.0	76302.5	1.0	4.9	0.0
63.9	2519.1	209162.3	61.6	77499.9	1.0	4.9	0.0
64.9	2491.4	211362.8	61.3	78697.4	1.0	4.9	0.0
65.9	2463.8	213531.8	60.9	79894.7	1.0	4.9	0.0
66.9	2436.3	215669.3	60.6	81092.1	1.0	4.9	0.0
67.9	2408.8	217775.2	60.2	82289.5	1.0	4.9	0.0
68.9	2381.5	219849.6	59.8	83486.9	1.0	4.9	0.0
69.9	2354.4	221892.5	59.4	84684.3	1.0	4.9	0.0
70.9	2327.3	223903.9	59.0	85881.6	1.0	4.9	0.0
71.9	2300.3	225883.8	58.6	87079.0	1.0	4.9	0.0
72.9	2273.5	227832.2	58.2	88276.4	1.0	4.9	0.0
73.9	2246.8	229749.1	57.8	89473.7	1.0	4.9	0.0
74.9	2220.2	231634.5	57.4	90671.1	1.0	4.9	0.0
75.9	2193.8	233488.5	56.9	91868.4	1.0	4.9	0.0
76.9	2167.5	235311.0	56.5	93065.8	1.0	4.9	0.0
77.9	2141.3	237102.0	56.0	94263.1	1.0	4.9	0.0
78.9	2115.3	238861.5	55.5	95460.5	1.0	4.9	0.0
79.9	2089.5	240589.6	55.0	96657.8	1.0	4.9	0.0
80.9	2063.8	242286.3	54.5	97855.1	1.0	4.9	0.0
81.9	2038.2	243951.5	54.0	99052.5	1.0	4.9	0.0
82.9	2012.9	245585.3	53.5	100249.8	1.0	4.9	0.0

83.9	1987.7	247187.6	53.0	101447.1	1.0	4.9	0.0
84.9	1962.7	248758.5	52.4	102644.5	1.0	4.9	0.0
85.9	1937.9	250298.0	51.8	103841.8	1.0	4.9	0.0
86.9	1913.3	251806.1	51.3	105039.1	1.0	4.9	0.0
87.9	1888.9	253282.7	50.7	106236.5	1.0	4.9	0.0
88.9	1864.7	254728.0	50.1	107433.8	1.0	4.9	0.0
89.9	1840.8	256141.9	49.4	108631.1	1.0	4.9	0.0
90.9	1817.0	257524.3	48.8	109828.4	1.0	4.9	0.0
91.9	1793.5	258875.4	48.1	111025.7	1.0	4.9	0.0
92.9	1770.3	260195.0	47.4	112223.1	1.0	4.9	0.0
93.9	1747.3	261483.3	46.7	113420.4	1.0	4.9	0.0
94.9	1724.6	262740.2	46.0	114617.7	1.0	4.9	0.0
95.9	1702.1	263965.7	45.3	115815.0	1.0	4.9	0.0
96.9	1680.0	265159.9	44.5	117012.3	1.0	4.9	0.0
97.9	1658.1	266322.6	43.8	118209.7	1.0	4.9	0.0
98.9	1636.6	267454.0	43.0	119407.0	1.0	4.9	0.0
99.9	1615.4	268554.1	42.2	120604.3	1.0	4.9	0.0
100.9	1594.5	269622.8	41.3	121801.6	1.0	4.9	0.0
101.9	1573.9	270660.1	40.5	122998.9	1.0	4.9	0.0
102.9	1553.8	271666.0	39.6	124196.3	1.0	4.9	0.0
103.9	1534.0	272640.6	38.7	125393.6	1.0	4.9	0.0
104.9	1514.6	273583.9	37.8	126590.9	1.0	4.9	0.0
105.9	1495.6	274495.8	36.8	127788.2	1.0	4.9	0.0
106.9	1477.0	275376.4	35.8	128985.5	1.0	4.9	0.0
107.9	1458.9	276225.6	34.8	130182.8	1.0	4.9	0.0
108.9	1441.2	277043.5	33.8	131380.1	1.0	4.9	0.0
109.9	1424.0	277830.1	32.8	132577.5	1.0	4.9	0.0
110.9	1407.3	278585.3	31.7	133774.8	1.0	4.9	0.0
111.9	1391.1	279309.2	30.6	134972.1	1.0	4.9	0.0
112.9	1375.4	280001.7	29.5	136169.4	1.0	4.9	0.0
113.9	1360.3	280663.0	28.3	137366.7	1.0	4.9	0.0
114.9	1345.7	281292.9	27.2	138564.0	1.0	4.9	0.0
115.9	1331.7	281891.5	26.0	139761.3	1.0	4.9	0.0
116.9	1318.3	282458.7	24.7	140958.7	1.0	4.9	0.0
117.9	1305.5	282994.7	23.5	142156.0	1.0	4.9	0.0
118.9	1293.3	283499.3	22.2	143353.3	1.0	4.9	0.0
119.9	1281.8	283972.6	20.9	144550.6	1.0	4.9	0.0
120.9	1271.0	284414.6	19.6	145747.9	1.0	4.9	0.0
121.9	1260.8	284825.3	18.3	146945.2	1.0	4.9	0.0
122.9	1251.3	285204.6	16.9	148142.5	1.0	4.9	0.0
123.9	1242.6	285552.7	15.5	149339.8	1.0	4.9	0.0
124.9	1234.6	285869.4	14.1	150537.2	1.0	4.9	0.0
125.9	1227.3	286154.8	12.7	151734.5	1.0	4.9	0.0
126.9	1220.8	286409.0	11.3	152931.8	1.0	4.9	0.0
127.9	1215.1	286631.8	9.8	154129.1	1.0	4.9	0.0
128.9	1210.2	286823.3	8.4	155326.4	1.0	4.9	0.0
129.9	1206.0	286983.5	6.9	156523.7	1.0	4.9	0.0
130.9	1202.7	287112.4	5.4	157721.0	1.0	4.9	0.0
131.9	1200.1	287210.0	3.9	158918.3	1.0	4.9	0.0
132.9	1198.4	287276.2	2.4	160115.6	1.0	4.9	0.0
133.9	1197.5	287311.2	0.9	161313.0	1.0	4.9	0.0
134.9	1197.4	287314.9	-0.6	162510.3	1.0	4.9	0.0
135.9	1198.1	287287.2	-2.1	163707.6	1.0	4.9	0.0
136.9	1199.6	287228.3	-3.6	164904.9	1.0	4.9	0.0
137.9	1202.0	287138.0	-5.1	166102.2	1.0	4.9	0.0
138.9	1205.1	287016.5	-6.5	167299.5	1.0	4.9	0.0
139.9	1209.1	286863.6	-8.0	168496.8	1.0	4.9	0.0
140.9	1213.9	286679.5	-9.5	169694.1	1.0	4.9	0.0
141.9	1219.4	286464.0	-10.9	170891.4	1.0	4.9	0.0

142.9	1225.7	286217.2	-12.4	172088.7	1.0	4.9	0.0
143.9	1232.8	285939.1	-13.8	173286.0	1.0	4.9	0.0
144.9	1240.6	285629.7	-15.2	174483.4	1.0	4.9	0.0
145.9	1249.2	285289.0	-16.6	175680.7	1.0	4.9	0.0
146.9	1258.5	284917.0	-17.9	176878.0	1.0	4.9	0.0
147.9	1268.5	284513.6	-19.3	178075.3	1.0	4.9	0.0
148.9	1279.2	284079.0	-20.6	179272.6	1.0	4.9	0.0
149.9	1290.5	283613.0	-21.9	180469.9	1.0	4.9	0.0
150.9	1302.6	283115.7	-23.2	181667.2	1.0	4.9	0.0
151.9	1315.2	282587.1	-24.4	182864.5	1.0	4.9	0.0
152.9	1328.5	282027.2	-25.7	184061.8	1.0	4.9	0.0
153.9	1342.3	281436.0	-26.9	185259.1	1.0	4.9	0.0
154.9	1356.8	280813.4	-28.1	186456.4	1.0	4.9	0.0
155.9	1371.8	280159.5	-29.2	187653.7	1.0	4.9	0.0
156.9	1387.4	279474.3	-30.3	188851.1	1.0	4.9	0.0
157.9	1403.5	278757.7	-31.4	190048.4	1.0	4.9	0.0
158.9	1420.0	278009.9	-32.5	191245.7	1.0	4.9	0.0
159.9	1437.1	277230.7	-33.6	192443.0	1.0	4.9	0.0
160.9	1454.7	276420.1	-34.6	193640.3	1.0	4.9	0.0
161.9	1472.7	275578.2	-35.6	194837.6	1.0	4.9	0.0
162.9	1491.2	274705.0	-36.6	196034.9	1.0	4.9	0.0
163.9	1510.1	273800.4	-37.5	197232.2	1.0	4.9	0.0
164.9	1529.4	272864.5	-38.5	198429.5	1.0	4.9	0.0
165.9	1549.1	271897.3	-39.4	199626.8	1.0	4.9	0.0
166.9	1569.2	270898.7	-40.3	200824.1	1.0	4.9	0.0
167.9	1589.6	269868.7	-41.1	202021.4	1.0	4.9	0.0
168.9	1610.4	268807.4	-42.0	203218.7	1.0	4.9	0.0
169.9	1631.6	267714.7	-42.8	204416.0	1.0	4.9	0.0
170.9	1653.0	266590.7	-43.6	205613.3	1.0	4.9	0.0
171.9	1674.8	265435.2	-44.4	206810.6	1.0	4.9	0.0
172.9	1696.9	264248.5	-45.1	208007.9	1.0	4.9	0.0
173.9	1719.3	263030.3	-45.9	209205.2	1.0	4.9	0.0
174.9	1741.9	261780.8	-46.6	210402.5	1.0	4.9	0.0
175.9	1764.9	260499.9	-47.3	211599.8	1.0	4.9	0.0
176.9	1788.0	259187.6	-48.0	212797.1	1.0	4.9	0.0
177.9	1811.5	257843.9	-48.6	213994.4	1.0	4.9	0.0
178.9	1835.1	256468.8	-49.3	215191.7	1.0	4.9	0.0
179.9	1859.1	255062.3	-49.9	216389.0	1.0	4.9	0.0
180.9	1883.2	253624.5	-50.5	217586.3	1.0	4.9	0.0
181.9	1907.5	252155.2	-51.1	218783.6	1.0	4.9	0.0
182.9	1932.1	250654.5	-51.7	219980.9	1.0	4.9	0.0
183.9	1956.8	249122.4	-52.3	221178.2	1.0	4.9	0.0
184.9	1981.8	247558.9	-52.8	222375.5	1.0	4.9	0.0
185.9	2006.9	245964.0	-53.4	223572.8	1.0	4.9	0.0
186.9	2032.2	244337.6	-53.9	224770.1	1.0	4.9	0.0
187.9	2057.7	242679.8	-54.4	225967.3	1.0	4.9	0.0
188.9	2083.3	240990.6	-54.9	227164.6	1.0	4.9	0.0
189.9	2109.2	239269.9	-55.4	228361.9	1.0	4.9	0.0
190.9	2135.1	237517.8	-55.9	229559.2	1.0	4.9	0.0
191.9	2161.2	235734.2	-56.4	230756.5	1.0	4.9	0.0
192.9	2187.5	233919.2	-56.8	231953.7	1.0	4.9	0.0
193.9	2213.9	232072.7	-57.3	233151.0	1.0	4.9	0.0
194.9	2240.4	230194.8	-57.7	234348.3	1.0	4.9	0.0
195.9	2267.1	228285.4	-58.1	235545.5	1.0	4.9	0.0
196.9	2293.9	226344.5	-58.5	236742.8	1.0	4.9	0.0
197.9	2320.8	224372.1	-58.9	237940.1	1.0	4.9	0.0
198.9	2347.8	222368.2	-59.3	239137.3	1.0	4.9	0.0
199.9	2374.9	220332.9	-59.7	240334.6	1.0	4.9	0.0
200.9	2402.2	218266.1	-60.1	241531.8	1.0	4.9	0.0

201.9	2429.6	216167.7	-60.5	242729.0	1.0	4.9	0.0
202.9	2457.0	214037.9	-60.8	243926.3	1.0	4.9	0.0
203.9	2484.6	211876.5	-61.2	245123.5	1.0	4.9	0.0
204.9	2512.2	209683.6	-61.5	246320.7	1.0	4.9	0.0
205.9	2540.0	207459.2	-61.9	247517.9	1.0	4.9	0.0
206.9	2567.8	205203.3	-62.2	248715.1	1.0	4.9	0.0
207.9	2595.8	202915.8	-62.5	249912.3	1.0	4.9	0.0
208.9	2623.8	200596.8	-62.9	251109.5	1.0	4.9	0.0
209.9	2651.9	198246.3	-63.2	252306.7	1.0	4.9	0.0
210.9	2680.1	195864.2	-63.5	253503.8	1.0	4.9	0.0
211.9	2708.3	193450.6	-63.8	254700.9	1.0	4.9	0.0
212.9	2736.7	191005.4	-64.1	255898.1	1.0	4.9	0.0
213.9	2765.1	188528.7	-64.3	257095.2	1.0	4.9	0.0
214.9	2793.6	186020.4	-64.6	258292.3	1.0	4.9	0.0
215.9	2822.1	183480.5	-64.9	259489.3	1.0	4.9	0.0
216.9	2850.7	180909.1	-65.2	260686.4	1.0	4.9	0.0
217.9	2879.4	178306.1	-65.4	261883.4	1.0	4.9	0.0
218.9	2908.1	175671.5	-65.7	263080.4	1.0	4.9	0.0
219.9	2936.9	173005.4	-65.9	264277.3	1.0	4.9	0.0
220.9	2965.8	170307.7	-66.2	265474.3	1.0	4.9	0.0
221.9	2994.7	167578.4	-66.4	266671.2	1.0	4.9	0.0
222.9	3023.6	164817.5	-66.7	267868.0	1.0	4.9	0.0
223.9	3052.6	162025.1	-66.9	269064.8	1.0	4.9	0.0
224.9	3081.6	159201.1	-67.1	270261.6	1.0	4.9	0.0
225.9	3110.7	156345.6	-67.4	271458.3	1.0	4.9	0.0
226.9	3139.8	153458.5	-67.6	272654.9	1.0	4.9	0.0
227.9	3169.0	150539.8	-67.8	273851.5	1.0	4.9	0.0
228.9	3198.1	147589.7	-68.0	275048.0	1.0	4.9	0.0
229.9	3227.3	144608.0	-68.2	276244.4	1.0	4.9	0.0
230.9	3256.5	141594.9	-68.4	277440.7	1.0	4.9	0.0
231.9	3285.8	138550.3	-68.7	278636.9	1.0	4.9	0.1
232.9	3315.0	135474.3	-68.9	279832.9	1.0	4.9	0.1
233.9	3344.2	132366.9	-69.0	281028.8	1.0	4.9	0.1
234.9	3373.4	129228.1	-69.2	282224.6	1.0	4.9	0.1
235.9	3402.5	126058.1	-69.4	283420.1	1.0	4.9	0.1
236.9	3431.6	122856.9	-69.6	284615.5	1.0	4.9	0.1
237.9	3460.7	119624.6	-69.8	285810.5	1.0	4.9	0.1
238.9	3489.6	116361.3	-70.0	287005.3	1.0	4.9	0.2
239.9	3518.5	113067.1	-70.2	288199.8	1.0	4.9	0.2
240.9	3547.2	109742.2	-70.3	289393.8	0.9	4.9	0.2
241.9	3575.6	106386.7	-70.5	290587.4	0.9	4.9	0.3
242.9	3603.9	103001.0	-70.7	291780.4	0.9	5.0	0.3
243.9	3631.9	99585.2	-70.8	292972.8	0.9	5.0	0.4
244.9	3659.5	96139.7	-71.0	294164.4	0.9	5.0	0.4
245.9	3686.6	92665.0	-71.2	295355.2	0.9	5.0	0.5
246.9	3713.2	89161.5	-71.3	296544.8	0.9	5.0	0.6
247.9	3739.1	85629.8	-71.5	297733.2	0.9	5.0	0.7
248.9	3764.1	82070.9	-71.6	298920.1	0.8	5.0	0.9
249.9	3788.1	78485.5	-71.8	300105.1	0.8	5.0	1.1
250.9	3810.8	74874.7	-71.9	301288.0	0.8	5.0	1.3
251.9	3832.0	71240.0	-72.1	302468.2	0.7	5.0	1.6
252.9	3851.5	67582.9	-72.2	303645.4	0.6	5.0	1.9
253.9	3868.7	63905.3	-72.4	304818.9	0.6	5.0	2.2
254.9	3883.4	60209.6	-72.5	305988.0	0.5	5.0	2.7
255.9	3894.9	56498.4	-72.7	307151.9	0.4	5.0	3.2
256.9	3902.6	52775.1	-72.8	308309.6	0.3	5.0	3.9
257.9	3905.9	49043.8	-72.9	309459.9	0.3	5.0	4.6
258.9	3903.8	45309.0	-73.1	310601.4	0.3	5.0	5.5
259.9	3895.5	41576.4	-73.2	311732.4	0.5	5.0	6.6

260.9	3879.8	37852.6	−73.3	312851.2	0.7	5.0	7.8
261.9	3855.8	34145.1	−73.5	313955.5	0.9	5.0	9.1
262.9	3823.9	30461.8	−73.6	315043.1	1.2	5.0	10.4
263.9	3783.6	26810.5	−73.8	316111.9	1.4	5.0	11.7
264.9	3734.7	23199.5	−73.9	317159.6	1.7	5.0	13.1
265.9	3676.8	19637.4	−74.0	318183.9	2.0	5.0	14.5
266.9	3609.9	16132.8	−74.2	319182.5	2.2	5.0	15.9
267.9	3534.0	12694.5	−74.3	320153.3	2.5	5.0	17.3
268.9	3449.5	9331.0	−74.4	321093.9	2.8	5.0	18.6
269.9	3356.6	6050.8	−74.6	322002.5	3.0	5.0	19.9
270.9	3256.1	2861.6	−74.7	322877.1	3.2	5.0	21.0
271.8	3156.9	−0.0	−74.9	323654.2	3.4	5.0	22.0

INITIAL DATA

Z(0)=	0.	AL=	1.3962E 00	V(0)= 10.0000E-02
ISP(0)=	2.3323E 02	K(T)=	6.4800E-01	D(B)= 8.3333E-02
D(N)=	2.5000E-01	M(B)=	1.5540E-01	M(0)= 8.7743E-01
M(P)=	5.2278E-01	MR=	2.8110E-01	

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
0.	0.1	0.	80.0	0.	70.7	28.2	0.0
0.1	231.3	11.3	79.6	2.1	73.0	27.3	1.1
0.2	470.0	45.7	79.5	8.4	75.4	26.4	4.6
0.3	716.7	104.0	79.5	19.2	77.9	25.5	10.7
0.4	971.4	186.9	79.4	34.6	80.4	24.6	19.5
0.5	1234.4	295.3	79.4	54.8	83.1	23.7	31.4
0.6	1506.0	429.9	79.4	80.0	85.8	22.8	46.6
0.7	1786.3	591.6	79.4	110.3	88.5	21.9	65.3
0.8	2075.6	781.3	79.4	146.0	91.3	21.0	87.6
0.9	2374.0	999.9	79.3	187.1	94.2	20.1	113.9
1.0	2681.8	1248.2	79.3	233.9	97.1	19.2	144.3
1.1	2999.2	1527.3	79.3	286.5	100.2	18.3	178.9
1.2	3326.3	1838.0	79.3	345.2	103.2	17.4	218.1
1.3	3663.4	2181.3	79.3	410.1	106.3	16.5	261.9
1.4	4010.7	2558.2	79.3	481.4	109.5	15.6	310.4
1.5	4368.3	2969.8	79.3	559.3	112.8	14.7	363.7
1.6	4736.6	3417.0	79.3	644.1	116.1	13.8	421.9
1.7	5115.7	3900.9	79.3	735.8	119.6	12.9	485.0
1.8	5506.0	4422.6	79.3	834.8	123.1	11.9	553.1
1.9	5744.8	4752.8	79.2	897.5	125.3	11.4	596.2
1.9	5744.8	4752.8	79.2	897.5	11.2	5.0	51.0
2.9	5427.1	10233.8	79.2	1941.2	8.7	5.0	38.7
3.9	5176.1	15436.1	79.1	2937.7	7.0	5.0	30.0
4.9	4973.3	20415.6	79.1	3897.7	5.7	5.0	23.6
5.9	4806.5	25213.4	79.0	4828.7	4.7	5.0	18.7
6.9	4667.3	29860.5	78.9	5736.7	4.0	5.0	14.9
7.9	4549.5	34380.6	78.8	6626.0	3.4	5.0	12.0
8.9	4448.9	38792.7	78.8	7500.4	2.9	5.0	9.5
9.9	4363.3	43112.5	78.7	8362.7	2.5	5.0	7.5
10.9	4289.1	47352.9	78.6	9215.6	2.2	5.0	5.9
11.9	4223.7	51523.9	78.5	10061.0	1.9	5.0	4.7
12.9	4165.2	55633.0	78.4	10900.2	1.7	5.0	3.8
13.9	4112.0	59686.2	78.3	11734.6	1.6	5.0	3.0
14.9	4063.0	63688.1	78.2	12565.0	1.5	5.0	2.5
15.9	4017.4	67642.4	78.1	13392.1	1.4	5.0	2.0
16.9	3974.5	71552.2	78.0	14216.6	1.3	5.0	1.6
17.9	3933.7	75419.6	77.9	15038.8	1.3	5.0	1.3
18.9	3894.7	79246.8	77.9	15859.3	1.2	5.0	1.1
19.9	3857.1	83035.1	77.8	16678.4	1.2	5.0	0.9
20.9	3820.8	86785.8	77.6	17496.1	1.1	5.0	0.7
21.9	3785.4	90500.0	77.5	18312.9	1.1	5.0	0.6
22.9	3750.7	94178.6	77.4	19128.9	1.1	5.0	0.5
23.9	3716.8	97822.3	77.3	19944.2	1.1	5.0	0.4

24.9	3683.3	101431.4	77.2	20758.9	1.1	5.0	0.3
25.9	3650.3	105006.7	77.1	21573.1	1.0	4.9	0.3
26.9	3617.6	108548.3	77.0	22386.9	1.0	4.9	0.2
27.9	3585.2	112056.6	76.9	23200.4	1.0	4.9	0.2
28.9	3553.0	115531.8	76.8	24013.5	1.0	4.9	0.2
29.9	3521.1	118974.2	76.7	24826.5	1.0	4.9	0.1
30.9	3489.3	122383.8	76.5	25639.2	1.0	4.9	0.1
31.9	3457.7	125761.0	76.4	26451.8	1.0	4.9	0.1
32.9	3426.2	129105.7	76.3	27264.2	1.0	4.9	0.1
33.9	3394.8	132418.0	76.2	28076.4	1.0	4.9	0.1
34.9	3363.6	135698.2	76.0	28888.6	1.0	4.9	0.1
35.9	3332.4	138946.2	75.9	29700.7	1.0	4.9	0.1
36.9	3301.3	142162.1	75.8	30512.6	1.0	4.9	0.0
37.9	3270.2	145345.9	75.6	31324.5	1.0	4.9	0.0
38.9	3239.3	148497.8	75.5	32136.3	1.0	4.9	0.0
39.9	3208.3	151617.7	75.3	32948.1	1.0	4.9	0.0
40.9	3177.5	154705.7	75.2	33759.8	1.0	4.9	0.0
41.9	3146.7	157761.9	75.1	34571.5	1.0	4.9	0.0
42.9	3115.9	160786.2	74.9	35383.1	1.0	4.9	0.0
43.9	3085.2	163778.7	74.7	36194.7	1.0	4.9	0.0
44.9	3054.6	166739.4	74.6	37006.3	1.0	4.9	0.0
45.9	3024.0	169668.3	74.4	37817.8	1.0	4.9	0.0
46.9	2993.4	172565.4	74.3	38629.3	1.0	4.9	0.0
47.9	2962.9	175430.9	74.1	39440.8	1.0	4.9	0.0
48.9	2932.4	178264.6	73.9	40252.3	1.0	4.9	0.0
49.9	2901.9	181066.7	73.8	41063.7	1.0	4.9	0.0
50.9	2871.5	183837.0	73.6	41875.2	1.0	4.9	0.0
51.9	2841.2	186575.7	73.4	42686.6	1.0	4.9	0.0
52.9	2810.9	189282.7	73.2	43498.0	1.0	4.9	0.0
53.9	2780.6	191958.1	73.0	44309.4	1.0	4.9	0.0
54.9	2750.4	194601.9	72.8	45120.8	1.0	4.9	0.0
55.9	2720.2	197214.0	72.6	45932.1	1.0	4.9	0.0
56.9	2690.0	199794.6	72.4	46743.5	1.0	4.9	0.0
57.9	2659.9	202343.6	72.2	47554.8	1.0	4.9	0.0
58.9	2629.9	204860.9	72.0	48366.2	1.0	4.9	0.0
59.9	2599.9	207346.7	71.8	49177.5	1.0	4.9	0.0
60.9	2569.9	209801.0	71.6	49988.8	1.0	4.9	0.0
61.9	2540.0	212223.6	71.4	50800.2	1.0	4.9	0.0
62.9	2510.1	214614.8	71.1	51611.5	1.0	4.9	0.0
63.9	2480.3	216974.4	70.9	52422.8	1.0	4.9	0.0
64.9	2450.5	219302.5	70.7	53234.1	1.0	4.9	0.0
65.9	2420.8	221599.0	70.4	54045.4	1.0	4.9	0.0
66.9	2391.1	223864.1	70.2	54856.7	1.0	4.9	0.0
67.9	2361.5	226097.6	69.9	55668.0	1.0	4.9	0.0
68.9	2332.0	228299.7	69.6	56479.3	1.0	4.9	0.0
69.9	2302.5	230470.2	69.4	57290.6	1.0	4.9	0.0
70.9	2273.1	232609.3	69.1	58101.9	1.0	4.9	0.0
71.9	2243.7	234716.9	68.8	58913.2	1.0	4.9	0.0
72.9	2214.4	236793.1	68.5	59724.5	1.0	4.9	0.0
73.9	2185.1	238837.7	68.2	60535.8	1.0	4.9	0.0
74.9	2156.0	240851.0	67.9	61347.0	1.0	4.9	0.0
75.9	2126.9	242832.7	67.6	62158.3	1.0	4.9	0.0
76.9	2097.8	244783.1	67.2	62969.6	1.0	4.9	0.0
77.9	2068.9	246702.0	66.9	63780.9	1.0	4.9	0.0
78.9	2040.0	248589.5	66.6	64592.2	1.0	4.9	0.0
79.9	2011.2	250445.5	66.2	65403.5	1.0	4.9	0.0
80.9	1982.5	252270.2	65.8	66214.7	1.0	4.9	0.0
81.9	1953.9	254063.4	65.5	67026.0	1.0	4.9	0.0
82.9	1925.4	255825.2	65.1	67837.3	1.0	4.9	0.0

83.9	1897.0	257555.6	64.7	68648.6	1.0	4.9	0.0
84.9	1868.6	259254.6	64.3	69459.8	1.0	4.9	0.0
85.9	1840.4	260922.3	63.8	70271.1	1.0	4.9	0.0
86.9	1812.3	262558.5	63.4	71082.4	1.0	4.9	0.0
87.9	1784.3	264163.4	63.0	71893.7	1.0	4.9	0.0
88.9	1756.4	265736.9	62.5	72704.9	1.0	4.9	0.0
89.9	1728.6	267279.0	62.0	73516.2	1.0	4.9	0.0
90.9	1701.0	268789.8	61.5	74327.5	1.0	4.9	0.0
91.9	1673.5	270269.2	61.0	75138.7	1.0	4.9	0.0
92.9	1646.2	271717.2	60.5	75950.0	1.0	4.9	0.0
93.9	1618.9	273133.9	59.9	76761.3	1.0	4.9	0.0
94.9	1591.9	274519.2	59.4	77572.6	1.0	4.9	0.0
95.9	1565.0	275873.2	58.8	78383.8	1.0	4.9	0.0
96.9	1538.3	277195.9	58.2	79195.1	1.0	4.9	0.0
97.9	1511.8	278487.2	57.5	80006.4	1.0	4.9	0.0
98.9	1485.4	279747.2	56.9	80817.6	1.	4.9	0.0
99.9	1459.3	280975.8	56.2	81628.9	1.	4.9	0.0
100.9	1433.4	282173.2	55.5	82440.2	1.0	4.9	0.0
101.9	1407.6	283339.2	54.8	83251.5	1.0	4.9	0.0
102.9	1382.2	284473.9	54.1	84062.7	1.0	4.9	0.0
103.9	1356.9	285577.3	53.3	84874.0	1.0	4.9	0.0
104.9	1332.0	286649.3	52.5	85685.3	1.0	4.9	0.0
105.9	1307.3	287690.1	51.6	86496.5	1.0	4.9	0.0
106.9	1282.9	288699.6	50.8	87307.8	1.0	4.9	0.0
107.9	1258.8	289677.7	49.9	88119.1	1.0	4.9	0.0
108.9	1235.0	290624.6	48.9	88930.3	1.0	4.9	0.0
109.9	1211.6	291540.1	48.0	89741.6	1.0	4.9	0.0
110.9	1188.6	292424.4	47.0	90552.9	1.0	4.9	0.0
111.9	1165.9	293277.4	45.9	91364.2	1.0	4.9	0.0
112.9	1143.6	294099.1	44.8	92175.4	1.0	4.9	0.0
113.9	1121.8	294889.5	43.7	92986.7	1.0	4.9	0.0
114.9	1100.4	295648.6	42.5	93798.0	1.0	4.9	0.0
115.9	1079.5	296376.4	41.3	94609.2	1.0	4.9	0.0
116.9	1059.2	297073.0	40.0	95420.5	1.0	4.9	0.0
117.9	1039.3	297738.3	38.7	96231.8	1.0	4.9	0.0
118.9	1020.1	298372.3	37.3	97043.0	1.0	4.9	0.0
119.9	1001.4	298975.0	35.9	97854.3	1.0	4.9	0.0
120.9	983.4	299546.5	34.4	98665.6	1.0	4.9	0.0
121.9	966.1	300086.7	32.9	99476.8	1.0	4.9	0.0
122.9	949.5	300595.6	31.3	100288.1	1.0	4.9	0.0
123.9	933.6	301073.3	29.7	101099.4	1.0	4.9	0.0
124.9	918.5	301519.7	28.0	101910.7	1.0	4.9	0.0
125.9	904.3	301934.8	26.2	102721.9	1.0	4.9	0.0
126.9	890.9	302318.7	24.4	103533.2	1.0	4.9	0.0
127.9	878.5	302671.3	22.6	104344.5	1.0	4.9	0.0
128.9	867.0	302992.7	20.6	105155.7	1.0	4.9	0.0
129.9	856.4	303282.7	18.7	105967.0	1.0	4.9	0.0
130.9	846.9	303541.6	16.7	106778.3	1.0	4.9	0.0
131.9	838.5	303769.2	14.6	107589.5	1.0	4.9	0.0
132.9	831.1	303965.5	12.6	108400.8	1.0	4.9	0.0
133.9	824.9	304130.5	10.4	109212.1	1.0	4.9	0.0
134.9	819.8	304264.3	8.3	110023.3	1.0	4.9	0.0
135.9	815.9	304366.9	6.1	110834.6	1.0	4.9	0.0
136.9	813.2	304438.2	3.9	111645.9	1.0	4.9	0.0
137.9	811.6	304478.2	1.7	112457.1	1.0	4.9	0.0
138.9	811.3	304487.0	-0.5	113268.4	1.0	4.9	0.0
139.9	812.2	304464.5	-2.7	114079.7	1.0	4.9	0.0
140.9	814.2	304410.8	-4.9	114891.0	1.0	4.9	0.0
141.9	817.5	304325.8	-7.1	115702.2	1.0	4.9	0.0

142.9	821.9	304209.6	-9.2	116513.5	1.0	4.9	0.0
143.9	827.5	304062.1	-11.4	117324.8	1.0	4.9	0.0
144.9	834.2	303883.4	-13.5	118136.0	1.0	4.9	0.0
145.9	842.1	303673.4	-15.5	118947.3	1.0	4.9	0.0
146.9	851.0	303432.1	-17.6	119758.6	1.0	4.9	0.0
147.9	860.9	303159.6	-19.6	120569.8	1.0	4.9	0.0
148.9	871.9	302855.8	-21.5	121381.1	1.0	4.9	0.0
149.9	883.8	302520.8	-23.4	122192.4	1.0	4.9	0.0
150.9	896.7	302154.5	-25.2	123003.6	1.0	4.9	0.0
151.9	910.4	301756.9	-27.0	123814.9	1.0	4.9	0.0
152.9	925.0	301328.1	-28.7	124626.2	1.0	4.9	0.0
153.9	940.5	300868.0	-30.4	125437.4	1.0	4.9	0.0
154.9	956.7	300376.7	-32.0	126248.7	1.0	4.9	0.0
155.9	973.6	299854.1	-33.6	127060.0	1.0	4.9	0.0
156.9	991.2	299300.2	-35.1	127871.2	1.0	4.9	0.0
157.9	1009.5	298715.0	-36.5	128682.5	1.0	4.9	0.0
158.9	1028.4	298098.6	-37.9	129493.8	1.0	4.9	0.0
159.9	1047.9	297450.9	-39.3	130305.1	1.0	4.9	0.0
160.9	1068.0	296771.9	-40.6	131116.3	1.0	4.9	0.0
161.9	1088.6	296061.6	-41.8	131927.6	1.0	4.9	0.0
162.9	1109.7	295320.1	-43.0	132738.9	1.0	4.9	0.0
163.9	1131.3	294547.3	-44.2	133550.1	1.0	4.9	0.0
164.9	1153.3	293743.2	-45.3	134361.4	1.0	4.9	0.0
165.9	1175.8	292907.8	-46.4	135172.7	1.0	4.9	0.0
166.9	1198.6	292041.1	-47.4	135983.9	1.0	4.9	0.0
167.9	1221.8	291143.2	-48.4	136795.2	1.0	4.9	0.0
168.9	1245.4	290213.9	-49.4	137606.5	1.0	4.9	0.0
169.9	1269.3	289253.3	-50.3	138417.7	1.0	4.9	0.0
170.9	1293.5	288261.5	-51.2	139229.0	1.0	4.9	0.0
171.9	1318.1	287238.3	-52.0	140040.3	1.0	4.9	0.0
172.9	1342.9	286183.9	-52.8	140851.5	1.0	4.9	0.0
173.9	1368.0	285098.1	-53.6	141662.8	1.0	4.9	0.0
174.9	1393.3	283981.0	-54.4	142474.1	1.0	4.9	0.0
175.9	1418.9	282832.6	-55.1	143285.3	1.0	4.9	0.0
176.9	1444.7	281652.9	-55.8	144096.6	1.0	4.9	0.0
177.9	1470.7	280441.8	-56.5	144907.9	1.0	4.9	0.0
178.9	1496.9	279199.4	-57.2	145719.1	1.0	4.9	0.0
179.9	1523.4	277925.7	-57.8	146530.4	1.0	4.9	0.0
180.9	1550.0	276620.7	-58.4	147341.7	1.0	4.9	0.0
181.9	1576.8	275284.3	-59.0	148152.9	1.0	4.9	0.0
182.9	1603.7	273916.6	-59.6	148964.2	1.0	4.9	0.0
183.9	1630.8	272517.6	-60.2	149775.5	1.0	4.9	0.0
184.9	1658.1	271087.2	-60.7	150586.7	1.0	4.9	0.0
185.9	1685.5	269625.4	-61.2	151398.0	1.0	4.9	0.0
186.9	1713.1	268132.3	-61.7	152209.3	1.0	4.9	0.0
187.9	1740.8	266607.8	-62.2	153020.5	1.0	4.9	0.0
188.9	1768.6	265052.0	-62.7	153831.8	1.0	4.9	0.0
189.9	1796.5	263464.8	-63.2	154643.1	1.0	4.9	0.0
190.9	1824.6	261846.2	-63.6	155454.3	1.0	4.9	0.0
191.9	1852.7	260196.2	-64.0	156265.6	1.0	4.9	0.0
192.9	1881.0	258514.9	-64.5	157076.8	1.0	4.9	0.0
193.9	1909.4	256802.1	-64.9	157888.1	1.0	4.9	0.0
194.9	1937.8	255058.0	-65.3	158699.4	1.0	4.9	0.0
195.9	1966.4	253282.4	-65.6	159510.6	1.0	4.9	0.0
196.9	1995.0	251475.5	-66.0	160321.9	1.0	4.9	0.0
197.9	2023.8	249637.1	-66.4	161133.2	1.0	4.9	0.0
198.9	2052.6	247767.4	-66.7	161944.4	1.0	4.9	0.0
199.9	2081.5	245866.2	-67.1	162755.7	1.0	4.9	0.0
200.9	2110.5	243933.5	-67.4	163566.9	1.0	4.9	0.0

201.9	2139.5	241969.5	-67.7	164378.2	1.0	4.9	0.0
202.9	2168.7	239974.0	-68.0	165189.4	1.0	4.9	0.0
203.9	2197.9	237947.1	-68.3	166000.7	1.0	4.9	0.0
204.9	2227.1	235888.7	-68.6	166811.9	1.0	4.9	0.0
205.9	2256.4	233798.9	-68.9	167623.2	1.0	4.9	0.0
206.9	2285.8	231677.6	-69.2	168434.4	1.0	4.9	0.0
207.9	2315.3	229524.8	-69.5	169245.7	1.0	4.9	0.0
208.9	2344.8	227340.6	-69.8	170056.9	1.0	4.9	0.0
209.9	2374.3	225124.9	-70.0	170868.2	1.0	4.9	0.0
210.9	2403.9	222877.7	-70.3	171679.4	1.0	4.9	0.0
211.9	2433.6	220599.0	-70.5	172490.6	1.0	4.9	0.0
212.9	2463.3	218288.9	-70.8	173301.9	1.0	4.9	0.0
213.9	2493.1	215947.2	-71.0	174113.1	1.0	4.9	0.0
214.9	2522.9	213574.0	-71.2	174924.3	1.0	4.9	0.0
215.9	2552.8	211169.3	-71.5	175735.5	1.0	4.9	0.0
216.9	2582.7	208733.1	-71.7	176546.7	1.0	4.9	0.0
217.9	2612.6	206265.4	-71.9	177357.9	1.0	4.9	0.0
218.9	2642.6	203766.2	-72.1	178169.1	1.0	4.9	0.0
219.9	2672.6	201235.4	-72.3	178980.3	1.0	4.9	0.0
220.9	2702.7	198673.1	-72.5	179791.5	1.0	4.9	0.0
221.9	2732.8	196079.2	-72.7	180602.7	1.0	4.9	0.0
222.9	2762.9	193453.8	-72.9	181413.9	1.0	4.9	0.0
223.9	2793.1	190796.8	-73.1	182225.0	1.0	4.9	0.0
224.9	2823.3	188108.3	-73.3	183036.2	1.0	4.9	0.0
225.9	2853.6	185388.3	-73.5	183847.3	1.0	4.9	0.0
226.9	2883.8	182636.6	-73.7	184658.4	1.0	4.9	0.0
227.9	2914.1	179853.4	-73.8	185469.5	1.0	4.9	0.0
228.9	2944.5	177038.7	-74.0	186280.6	1.0	4.9	0.0
229.9	2974.8	174192.4	-74.2	187091.6	1.0	4.9	0.0
230.9	3005.2	171314.5	-74.3	187902.7	1.0	4.9	0.0
231.9	3035.6	168405.0	-74.5	188713.7	1.0	4.9	0.0
232.9	3066.0	165464.0	-74.7	189524.7	1.0	4.9	0.0
233.9	3096.4	162491.4	-74.8	190335.6	1.0	4.9	0.0
234.9	3126.9	159487.3	-75.0	191146.6	1.0	4.9	0.0
235.9	3157.4	156451.6	-75.1	191957.5	1.0	4.9	0.0
236.9	3187.8	153384.4	-75.3	192768.3	1.0	4.9	0.0
237.9	3218.3	150285.6	-75.4	193579.1	1.0	4.9	0.0
238.9	3248.8	147155.3	-75.5	194389.8	1.0	4.9	0.0
239.9	3279.3	143993.6	-75.7	195200.5	1.0	4.9	0.0
240.9	3309.7	140800.4	-75.8	196011.1	1.0	4.9	0.1
241.9	3340.2	137575.8	-76.0	196821.7	1.0	4.9	0.1
242.9	3370.6	134319.7	-76.1	197632.1	1.0	4.9	0.1
243.9	3400.9	131032.4	-76.2	198442.5	1.0	4.9	0.1
244.9	3431.3	127713.7	-76.3	199252.7	1.0	4.9	0.1
245.9	3461.5	124363.9	-76.5	200062.7	1.0	4.9	0.1
246.9	3491.7	120982.9	-76.6	200872.7	1.0	4.9	0.1
247.9	3521.8	117571.0	-76.7	201682.4	1.0	4.9	0.1
248.9	3551.7	114128.1	-76.8	202491.9	1.0	4.9	0.2
249.9	3581.5	110654.5	-76.9	203301.1	0.9	4.9	0.2
250.9	3611.0	107150.5	-77.1	204110.1	0.9	4.9	0.2
251.9	3640.3	103616.1	-77.2	204918.7	0.9	5.0	0.3
252.9	3669.3	100051.7	-77.3	205726.8	0.9	5.0	0.4
253.9	3697.9	96457.8	-77.4	206534.5	0.9	5.0	0.4
254.9	3726.0	92834.6	-77.5	207341.5	0.9	5.0	0.5
255.9	3753.4	89182.8	-77.6	208147.8	0.9	5.0	0.6
256.9	3780.1	85503.1	-77.7	208953.3	0.8	5.0	0.8
257.9	3805.9	81796.2	-77.8	209757.7	0.8	5.0	0.9
258.9	3830.5	78063.3	-77.9	210560.8	0.8	5.0	1.1
259.9	3853.8	74305.6	-78.0	211362.4	0.7	5.0	1.4

260.9	3875.5	70524.4	-78.1	212162.2	0.7	5.0	1.6
261.9	3895.1	66721.7	-78.2	212959.8	0.6	5.0	2.0
262.9	3912.4	62899.6	-78.3	213754.8	0.5	5.0	2.4
263.9	3926.7	59060.6	-78.4	214546.7	0.4	5.0	2.9
264.9	3937.5	55208.0	-78.5	215334.8	0.3	5.0	3.5
265.9	3944.0	51345.5	-78.6	216118.4	0.2	5.0	4.2
266.9	3945.6	47477.7	-78.7	216896.6	0.2	5.0	5.1
267.9	3941.0	43610.2	-78.8	217668.3	0.3	5.0	6.1
268.9	3929.4	39749.2	-78.9	218432.3	0.5	5.0	7.3
269.9	3909.3	35902.5	-78.9	219187.3	0.8	5.0	8.7
270.9	3880.7	32078.5	-79.0	219931.5	1.0	5.0	10.0
271.9	3843.5	28285.7	-79.1	220663.5	1.3	5.0	11.4
272.9	3797.2	24532.6	-79.2	221381.6	1.6	5.0	12.8
273.9	3741.6	20828.5	-79.3	222084.4	1.9	5.0	14.3
274.9	3676.4	17182.6	-79.4	222770.0	2.2	5.0	15.8
275.9	3601.6	13604.5	-79.5	223437.0	2.5	5.0	17.3
276.9	3517.4	10103.5	-79.6	224083.7	2.8	5.0	18.7
277.9	3424.3	6688.7	-79.7	224708.6	3.0	5.0	20.1
278.9	3322.7	3368.6	-79.8	225310.5	3.3	5.0	21.3
279.9	3213.6	151.3	-79.9	225888.0	3.5	5.0	22.4
279.9	3208.2	-0.0	-79.9	225915.0	3.5	5.0	22.5

INITIAL DATA

Z(0)=	0.	AL=	1.4834E 00	V(0)=	10.0000E-02
ISP(0)=	2.3323E 02	K(T)=	6.4800E-01	D(B)=	8.3333E-02
D(M)=	2.5000E-01	M(B)=	1.5540E-01	M(0)=	8.7743E-01
M(P)=	5.2278E-01	MR=	2.8110E-01		

TIME	VEL.	ALT.	PATH ANGLE	RANGE	ACCEL.	WGT.	DRAG
(SEC)	(FT/SEC)	(FT)	(DEG)	(FT)	(G)	(LBS)	(LBS)
0.	0.1	0.	85.0	0.	70.7	28.2	0.0
0.1	231.2	11.5	84.8	1.0	73.0	27.3	1.1
0.2	469.9	46.3	84.8	4.2	75.4	26.4	4.6
0.3	716.5	105.3	84.7	9.6	77.9	25.5	10.7
0.4	971.2	189.3	84.7	17.4	80.4	24.6	19.5
0.5	1234.2	299.0	84.7	27.6	83.1	23.7	31.4
0.6	1505.7	435.3	84.7	40.2	85.7	22.8	46.6
0.7	1786.0	599.2	84.7	55.5	88.5	21.9	65.2
0.8	2075.3	791.3	84.7	73.4	91.3	21.0	87.6
0.9	2373.7	1012.7	84.7	94.1	94.2	20.1	113.8
1.0	2681.5	1264.3	84.7	117.6	97.1	19.2	144.2
1.1	2998.8	1547.0	84.6	144.0	100.1	18.3	178.8
1.2	3326.0	1861.8	84.6	173.5	103.2	17.4	217.9
1.3	3663.1	2209.6	84.6	206.2	106.3	16.5	261.6
1.4	4010.4	2591.5	84.6	242.0	109.5	15.6	310.0
1.5	4368.1	3008.5	84.6	281.2	112.8	14.7	363.2
1.6	4736.4	3461.7	84.6	323.8	116.2	13.8	421.3
1.7	5115.7	3952.0	84.6	370.0	119.6	12.9	484.3
1.8	5506.3	4480.7	84.6	419.8	123.2	11.9	552.2
1.9	5745.2	4815.4	84.6	451.3	125.4	11.4	595.1
1.9	5745.2	4815.4	84.6	451.3	11.2	5.0	50.9
2.9	5427.9	10370.6	84.6	976.3	8.7	5.0	38.5
3.9	5177.6	15644.9	84.6	1477.6	7.0	5.0	29.8
4.9	4975.7	20695.0	84.5	1960.7	5.7	5.0	23.3
5.9	4809.9	25562.7	84.5	2429.4	4.7	5.0	18.5
6.9	4671.5	30279.3	84.4	2886.5	3.9	5.0	14.7
7.9	4554.6	34869.0	84.4	3334.4	3.4	5.0	11.8
8.9	4455.1	39350.9	84.4	3775.0	2.8	5.0	9.3
9.9	4370.4	43741.0	84.3	4209.6	2.4	5.0	7.3
10.9	4296.9	48052.5	84.3	4639.6	2.1	5.0	5.7
11.9	4232.1	52295.0	84.2	5065.9	1.9	5.0	4.6
12.9	4174.0	56476.2	84.2	5489.3	1.7	5.0	3.6
13.9	4121.1	60601.9	84.2	5910.2	1.6	5.0	2.9
14.9	4072.4	64676.9	84.1	6329.3	1.5	5.0	2.4
15.9	4026.9	68704.7	84.1	6746.7	1.4	5.0	1.9
16.9	3984.0	72688.3	84.0	7162.9	1.3	5.0	1.6
17.9	3943.2	76629.9	84.0	7578.1	1.2	5.0	1.3
18.9	3904.1	80531.6	83.9	7992.4	1.2	5.0	1.0
19.9	3866.4	84394.6	83.9	8406.0	1.2	5.0	0.8
20.9	3829.8	88220.4	83.8	8819.0	1.1	5.0	0.7
21.9	3794.1	92009.9	83.8	9231.5	1.1	5.0	0.6
22.9	3759.2	95764.0	83.7	9643.7	1.1	5.0	0.5
23.9	3724.9	99483.2	83.7	10055.5	1.1	5.0	0.4

24.9	3691.0	103168.2	83.6	10467.1	1.1	5.0	0.3
25.9	3657.5	106819.3	83.5	10878.4	1.0	4.9	0.3
26.9	3624.4	110436.9	83.5	11289.6	1.0	4.9	0.2
27.9	3591.5	114021.3	83.4	11700.6	1.0	4.9	0.2
28.9	3558.8	117572.8	83.4	12111.4	1.0	4.9	0.2
29.9	3526.3	121091.4	83.3	12522.2	1.0	4.9	0.1
30.9	3494.0	124577.4	83.3	12932.8	1.0	4.9	0.1
31.9	3461.8	128030.9	83.2	13343.4	1.0	4.9	0.1
32.9	3429.7	131452.1	83.1	13753.9	1.0	4.9	0.1
33.9	3397.6	134841.0	83.1	14164.3	1.0	4.9	0.1
34.9	3365.7	138197.7	83.0	14574.7	1.0	4.9	0.1
35.9	3333.9	141522.2	82.9	14985.0	1.0	4.9	0.0
36.9	3302.1	144814.7	82.9	15395.3	1.0	4.9	0.0
37.9	3270.3	148075.2	82.8	15805.6	1.0	4.9	0.0
38.9	3238.7	151303.8	82.7	16215.8	1.0	4.9	0.0
39.9	3207.0	154500.4	82.7	16626.1	1.0	4.9	0.0
40.9	3175.4	157665.1	82.6	17036.2	1.0	4.9	0.0
41.9	3143.8	160798.0	82.5	17446.4	1.0	4.9	0.0
42.9	3112.3	163899.1	82.4	17856.6	1.0	4.9	0.0
43.9	3080.8	166968.4	82.3	18266.7	1.0	4.9	0.0
44.9	3049.3	170005.9	82.3	18676.8	1.0	4.9	0.0
45.9	3017.9	173011.6	82.2	19086.9	1.0	4.9	0.0
46.9	2966.5	175985.6	82.1	19497.0	1.0	4.9	0.0
47.9	2955.0	178927.9	82.0	19907.1	1.0	4.9	0.0
48.9	2923.7	181838.5	81.9	20317.2	1.0	4.9	0.0
49.9	2892.3	184717.5	81.8	20727.2	1.0	4.9	0.0
50.9	2861.0	187564.7	81.8	21137.3	1.0	4.9	0.0
51.9	2829.7	190380.4	81.7	21547.3	1.0	4.9	0.0
52.9	2798.4	193164.3	81.6	21957.4	1.0	4.9	0.0
53.9	2767.1	195916.7	81.5	22367.4	1.0	4.9	0.0
54.9	2735.8	198637.5	81.4	22777.5	1.0	4.9	0.0
55.9	2704.6	201326.6	81.3	23187.5	1.0	4.9	0.0
56.9	2673.4	203984.2	81.2	23597.5	1.0	4.9	0.0
57.9	2642.2	206610.1	81.1	24007.5	1.0	4.9	0.0
58.9	2611.0	209204.6	81.0	24417.6	1.0	4.9	0.0
59.9	2579.9	211767.4	80.9	24827.6	1.0	4.9	0.0
60.9	2548.7	214298.7	80.7	25237.6	1.0	4.9	0.0
61.9	2517.6	216798.5	80.6	25647.6	1.0	4.9	0.0
62.9	2486.5	219266.7	80.5	26057.6	1.0	4.9	0.0
63.9	2455.4	221703.5	80.4	26467.6	1.0	4.9	0.0
64.9	2424.4	224108.7	80.3	26877.6	1.0	4.9	0.0
65.9	2393.3	226482.4	80.1	27287.6	1.0	4.9	0.0
66.9	2362.3	228824.6	80.0	27697.6	1.0	4.9	0.0
67.9	2331.3	231135.3	79.9	28107.6	1.0	4.9	0.0
68.9	2300.3	233414.6	79.7	28517.6	1.0	4.9	0.0
69.9	2269.4	235662.4	79.6	28927.6	1.0	4.9	0.0
70.9	2238.5	237878.7	79.4	29337.6	1.0	4.9	0.0
71.9	2207.5	240063.6	79.3	29747.6	1.0	4.9	0.0
72.9	2176.6	242217.0	79.1	30157.6	1.0	4.9	0.0
73.9	2145.8	244338.9	79.0	30567.6	1.0	4.9	0.0
74.9	2114.9	246429.5	78.8	30977.6	1.0	4.9	0.0
75.9	2084.1	248488.6	78.7	31387.6	1.0	4.9	0.0
76.9	2053.3	250516.2	78.5	31797.6	1.0	4.9	0.0
77.9	2022.5	252512.5	78.3	32207.6	1.0	4.9	0.0
78.9	1991.8	254477.3	78.1	32617.6	1.0	4.9	0.0
79.9	1961.1	256410.8	77.9	33027.6	1.0	4.9	0.0
80.9	1930.4	258312.8	77.7	33437.6	1.0	4.9	0.0
81.9	1899.7	260183.5	77.5	33847.6	1.0	4.9	0.0
82.9	1869.1	262022.8	77.3	34257.6	1.0	4.9	0.0

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83.9	1858.5	263830.6	77.1	34667.5	1.0	4.9	0.0
84.9	1807.9	265607.1	76.9	35077.5	1.0	4.9	0.0
85.9	1777.4	267352.3	76.7	35487.5	1.0	4.9	0.0
86.9	1746.9	269066.1	76.4	35897.5	1.0	4.9	0.0
87.9	1716.4	270748.5	76.2	36307.5	1.0	4.9	0.0
88.9	1686.0	272399.5	75.9	36717.5	1.0	4.9	0.0
89.9	1655.6	274019.2	75.7	37127.5	1.0	4.9	0.0
90.9	1625.3	275607.6	75.4	37537.5	1.0	4.9	0.0
91.9	1594.9	277164.6	75.1	37947.5	1.0	4.9	0.0
92.9	1564.7	278690.3	74.8	38357.5	1.0	4.9	0.0
93.9	1534.5	280184.6	74.5	38767.5	1.0	4.9	0.0
94.9	1504.3	281647.7	74.2	39177.4	1.0	4.9	0.0
95.9	1474.2	283079.4	73.9	39587.4	1.0	4.9	0.0
96.9	1444.1	284479.7	73.5	39997.4	1.0	4.9	0.0
97.9	1414.2	285848.8	73.1	40407.4	1.0	4.9	0.0
98.9	1384.2	287186.6	72.8	40817.4	1.0	4.9	0.0
99.9	1354.3	288493.0	72.4	41227.4	1.0	4.9	0.0
100.9	1324.6	289768.2	72.0	41637.4	1.0	4.9	0.0
101.9	1294.8	291012.0	71.5	42047.4	1.0	4.9	0.0
102.9	1265.2	292224.6	71.1	42457.4	1.0	4.9	0.0
103.9	1235.6	293405.9	70.6	42867.4	1.0	4.9	0.0
104.9	1206.2	294555.8	70.1	43277.4	1.0	4.9	0.0
105.9	1176.8	295674.5	69.6	43687.3	1.0	4.9	0.0
106.9	1147.5	296761.9	69.1	44097.3	1.0	4.9	0.0
107.9	1118.4	297818.1	68.5	44507.3	1.0	4.9	0.0
108.9	1089.3	298842.9	67.9	44917.3	1.0	4.9	0.0
109.9	1060.4	299836.5	67.3	45327.3	1.0	4.9	0.0
110.9	1031.7	300798.9	66.6	45737.3	1.0	4.9	0.0
111.9	1003.0	301729.9	65.9	46147.3	1.0	4.9	0.0
112.9	974.6	302629.7	65.1	46557.3	1.0	4.9	0.0
113.9	946.3	303498.2	64.3	46967.3	1.0	4.9	0.0
114.9	918.3	304335.5	63.5	47377.3	1.0	4.9	0.0
115.9	890.4	305141.5	62.6	47787.2	1.0	4.9	0.0
116.9	862.8	305916.3	61.6	48197.2	1.0	4.9	0.0
117.9	835.4	306659.8	60.6	48607.2	1.0	4.9	0.0
118.9	808.3	307372.1	59.5	49017.2	1.0	4.9	0.0
119.9	781.6	308053.1	58.4	49427.2	1.0	4.9	0.0
120.9	755.1	308702.9	57.1	49837.2	1.0	4.9	0.0
121.9	729.1	309321.4	55.8	50247.2	1.0	4.9	0.0
122.9	703.5	309908.7	54.4	50657.2	1.0	4.9	0.0
123.9	678.4	310464.8	52.8	51067.2	1.0	4.9	0.0
124.9	653.7	310989.6	51.2	51477.2	1.0	4.9	0.0
125.9	629.7	311483.2	49.4	51887.1	1.0	4.9	0.0
126.9	606.4	311945.5	47.5	52297.1	1.0	4.9	0.0
127.9	583.7	312376.6	45.4	52707.1	1.0	4.9	0.0
128.9	561.9	312776.5	43.1	53117.1	1.0	4.9	0.0
129.9	541.0	313145.2	40.7	53527.1	1.0	4.9	0.0
130.9	521.2	313482.6	38.1	53937.1	1.0	4.9	0.0
131.9	502.5	313788.8	35.3	54347.1	1.0	4.9	0.0
132.9	485.1	314063.8	32.3	54757.1	1.0	4.9	0.0
133.9	469.2	314307.5	29.1	55167.1	1.0	4.9	0.0
134.9	454.8	314520.0	25.7	55577.1	1.0	4.9	0.0
135.9	442.2	314701.3	22.0	55987.0	1.0	4.9	0.0
136.9	431.5	314851.4	18.2	56397.0	1.0	4.9	0.0
137.9	422.8	314970.2	14.1	56807.0	1.0	4.9	0.0
138.9	416.3	315057.8	10.0	57217.0	1.0	4.9	0.0
139.9	412.0	315114.2	5.7	57627.0	1.0	4.9	0.0
140.9	410.1	315139.4	1.3	58037.0	1.0	4.9	0.0
141.9	410.6	315133.3	-3.0	58447.0	1.0	4.9	0.0

142.9	413.4	315096.1	-7.4	58857.0	1.0	4.9	0.0
143.9	418.5	315027.6	-11.6	59267.0	1.0	4.9	0.0
144.9	425.9	314927.8	-15.7	59676.9	1.0	4.9	0.0
145.9	435.4	314796.9	-19.7	60086.9	1.0	4.9	0.0
146.9	446.9	314634.7	-23.4	60496.9	1.0	4.9	0.0
147.9	460.2	314441.3	-27.0	60906.9	1.0	4.9	0.0
148.9	475.2	314216.7	-30.4	61316.9	1.0	4.9	0.0
149.9	491.7	313960.9	-33.5	61726.9	1.0	4.9	0.0
150.9	509.6	313673.8	-36.4	62136.9	1.0	4.9	0.0
151.9	528.8	313355.5	-39.2	62546.9	1.0	4.9	0.0
152.9	549.0	313006.0	-41.7	62956.9	1.0	4.9	0.0
153.9	570.3	312625.2	-44.0	63366.9	1.0	4.9	0.0
154.9	592.4	312213.2	-46.2	63776.8	1.0	4.9	0.0
155.9	615.3	311770.0	-48.2	64186.8	1.0	4.9	0.0
156.9	639.0	311295.5	-50.1	64596.8	1.0	4.9	0.0
157.9	663.2	310789.8	-51.8	65006.8	1.0	4.9	0.0
158.9	688.0	310252.9	-53.4	65416.8	1.0	4.9	0.0
159.9	713.4	309684.7	-54.9	65826.8	1.0	4.9	0.0
160.9	739.2	309085.3	-56.3	66236.8	1.0	4.9	0.0
161.9	765.3	308454.7	-57.6	66646.8	1.0	4.9	0.0
162.9	791.9	307792.8	-58.8	67056.8	1.0	4.9	0.0
163.9	818.8	307099.7	-60.0	67466.8	1.0	4.9	0.0
164.9	846.0	306375.3	-61.0	67876.7	1.0	4.9	0.0
165.9	873.5	305619.7	-62.0	68286.7	1.0	4.9	0.0
166.9	901.2	304832.8	-62.9	68696.7	1.0	4.9	0.0
167.9	929.1	304014.6	-63.8	69106.7	1.0	4.9	0.0
168.9	957.3	303165.2	-64.6	69516.7	1.0	4.9	0.0
169.9	985.6	302284.6	-65.4	69926.7	1.0	4.9	0.0
170.9	1014.1	301372.7	-66.2	70336.7	1.0	4.9	0.0
171.9	1042.8	300429.5	-66.8	70746.7	1.0	4.9	0.0
172.9	1071.6	299455.1	-67.5	71156.7	1.0	4.9	0.0
173.9	1100.6	298449.4	-68.1	71566.7	1.0	4.9	0.0
174.9	1129.6	297412.4	-68.7	71976.6	1.0	4.9	0.0
175.9	1158.8	296344.1	-69.3	72386.6	1.0	4.9	0.0
176.9	1188.2	295244.6	-69.8	72796.6	1.0	4.9	0.0
177.9	1217.6	294113.8	-70.3	73206.6	1.0	4.9	0.0
178.9	1247.1	292951.6	-70.8	73616.6	1.0	4.9	0.0
179.9	1276.7	291758.3	-71.3	74026.6	1.0	4.9	0.0
180.9	1306.3	290533.6	-71.7	74436.6	1.0	4.9	0.0
181.9	1336.1	289277.6	-72.1	74846.6	1.0	4.9	0.0
182.9	1365.9	287990.3	-72.5	75256.6	1.0	4.9	0.0
183.9	1395.8	286671.7	-72.9	75666.5	1.0	4.9	0.0
184.9	1425.8	285321.8	-73.3	76076.5	1.0	4.9	0.0
185.9	1455.8	283940.6	-73.6	76486.5	1.0	4.9	0.0
186.9	1485.9	282528.1	-74.0	76896.5	1.0	4.9	0.0
187.9	1516.0	281084.2	-74.3	77306.5	1.0	4.9	0.0
188.9	1546.2	279609.1	-74.6	77716.5	1.0	4.9	0.0
189.9	1576.4	278102.6	-74.9	78126.5	1.0	4.9	0.0
190.9	1606.7	276564.8	-75.2	78536.5	1.0	4.9	0.0
191.9	1637.0	274995.6	-75.5	78946.5	1.0	4.9	0.0
192.9	1667.4	273395.1	-75.8	79356.5	1.0	4.9	0.0
193.9	1697.8	271763.3	-76.0	79766.4	1.0	4.9	0.0
194.9	1728.2	270100.1	-76.3	80176.4	1.0	4.9	0.0
195.9	1758.7	268405.5	-76.5	80586.4	1.0	4.9	0.0
196.9	1789.2	266679.6	-76.8	80996.4	1.0	4.9	0.0
197.9	1819.8	264922.3	-77.0	81406.4	1.0	4.9	0.0
198.9	1850.3	263133.6	-77.2	81816.4	1.0	4.9	0.0
199.9	1880.9	261313.6	-77.4	82226.4	1.0	4.9	0.0
200.9	1911.6	259462.2	-77.6	82636.4	1.0	4.9	0.0

201.9	1942.3	257579.4	-77.8	83046.3	1.0	4.9	0.0
202.9	1973.0	255665.2	-78.0	83456.3	1.0	4.9	0.0
203.9	2003.7	253719.6	-78.2	83866.3	1.0	4.9	0.0
204.9	2034.4	251742.6	-78.4	84276.3	1.0	4.9	0.0
205.9	2065.2	249734.2	-78.5	84686.3	1.0	4.9	0.0
206.9	2096.0	247694.4	-78.7	85096.3	1.0	4.9	0.0
207.9	2126.8	245623.1	-78.9	85506.3	1.0	4.9	0.0
208.9	2157.7	243520.5	-79.0	85916.2	1.0	4.9	0.0
209.9	2188.6	241386.4	-79.2	86326.2	1.0	4.9	0.0
210.9	2219.5	239220.8	-79.4	86736.2	1.0	4.9	0.0
211.9	2250.4	237023.9	-79.5	87146.2	1.0	4.9	0.0
212.9	2281.3	234795.4	-79.6	87556.2	1.0	4.9	0.0
213.9	2312.3	232535.5	-79.8	87966.2	1.0	4.9	0.0
214.9	2343.2	230244.2	-79.9	88376.1	1.0	4.9	0.0
215.9	2374.2	227921.4	-80.1	88786.1	1.0	4.9	0.0
216.9	2405.2	225567.1	-80.2	89196.1	1.0	4.9	0.0
217.9	2436.3	223181.3	-80.3	89606.1	1.0	4.9	0.0
218.9	2467.3	220764.0	-80.4	90016.0	1.0	4.9	0.0
219.9	2498.4	218315.3	-80.6	90426.0	1.0	4.9	0.0
220.9	2529.5	215835.0	-80.7	90836.0	1.0	4.9	0.0
221.9	2560.5	213323.3	-80.8	91245.9	1.0	4.9	0.0
222.9	2591.7	210780.0	-80.9	91655.9	1.0	4.9	0.0
223.9	2622.8	208205.2	-81.0	92065.9	1.0	4.9	0.0
224.9	2653.9	205598.9	-81.1	92475.8	1.0	4.9	0.0
225.9	2685.1	202961.1	-81.2	92885.8	1.0	4.9	0.0
226.9	2716.2	200291.7	-81.3	93295.7	1.0	4.9	0.0
227.9	2747.4	197590.8	-81.4	93705.7	1.0	4.9	0.0
228.9	2778.6	194858.3	-81.5	94115.6	1.0	4.9	0.0
229.9	2809.8	192094.3	-81.6	94525.6	1.0	4.9	0.0
230.9	2841.0	189298.8	-81.7	94935.5	1.0	4.9	0.0
231.9	2872.3	186471.7	-81.8	95345.4	1.0	4.9	0.0
232.9	2903.5	183613.1	-81.9	95755.3	1.0	4.9	0.0
233.9	2934.8	180722.8	-82.0	96165.3	1.0	4.9	0.0
234.9	2966.0	177801.1	-82.1	96575.2	1.0	4.9	0.0
235.9	2997.3	174847.7	-82.1	96985.1	1.0	4.9	0.0
236.9	3028.6	171862.8	-82.2	97394.9	1.0	4.9	0.0
237.9	3059.8	168846.3	-82.3	97804.8	1.0	4.9	0.0
238.9	3091.1	165798.3	-82.4	98214.7	1.0	4.9	0.0
239.9	3122.4	162718.7	-82.5	98624.5	1.0	4.9	0.0
240.9	3153.6	159607.6	-82.5	99034.3	1.0	4.9	0.0
241.9	3184.9	156464.9	-82.6	99444.1	1.0	4.9	0.0
242.9	3216.2	153290.7	-82.7	99853.9	1.0	4.9	0.0
243.9	3247.4	150085.0	-82.8	100263.7	1.0	4.9	0.0
244.9	3278.7	146847.8	-82.8	100673.4	1.0	4.9	0.0
245.9	3309.9	143579.1	-82.9	101083.1	1.0	4.9	0.0
246.9	3341.1	140278.9	-83.0	101492.8	1.0	4.9	0.1
247.9	3372.2	136947.4	-83.0	101902.4	1.0	4.9	0.1
248.9	3403.3	133584.4	-83.1	102312.0	1.0	4.9	0.1
249.9	3434.4	130190.2	-83.2	102721.5	1.0	4.9	0.1
250.9	3465.3	126764.7	-83.2	103131.0	1.0	4.9	0.1
251.9	3496.2	123308.1	-83.3	103540.3	1.0	4.9	0.1
252.9	3527.0	119820.4	-83.3	103949.6	1.0	4.9	0.1
253.9	3557.7	116301.7	-85.4	104358.8	1.0	4.9	0.2
254.9	3588.2	112752.3	-83.5	104767.9	1.0	4.9	0.2
255.9	3618.4	109172.2	-83.5	105176.8	0.9	4.9	0.2
256.9	3648.5	105561.8	-83.6	105585.6	0.9	4.9	0.3
257.9	3678.2	101921.3	-83.6	105994.2	0.9	5.0	0.3
258.9	3707.6	98251.0	-83.7	106402.5	0.9	5.0	0.4
259.9	3736.5	94551.4	-83.7	106810.6	0.9	5.0	0.5

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260.9	3764.8	90822.9	-83.8	107218.3	0.9	5.0	0.6
261.9	3792.4	87066.3	-83.8	107625.6	0.9	5.0	0.7
262.9	3819.0	83282.3	-83.9	108032.4	0.8	5.0	0.9
263.9	3844.6	79472.0	-83.9	108438.7	0.8	5.0	1.1
264.9	3868.9	75636.6	-84.0	108844.2	0.7	5.0	1.3
265.9	3891.5	71777.4	-84.0	109248.8	0.7	5.0	1.6
266.9	3912.3	67896.2	-84.1	109652.4	0.6	5.0	1.9
267.9	3930.6	63995.3	-84.1	110054.8	0.5	5.0	2.3
268.9	3946.2	60077.1	-84.2	110455.6	0.4	5.0	2.8
269.9	3958.2	56144.8	-84.2	110854.6	0.3	5.0	3.4
270.9	3966.1	52202.2	-84.3	111251.4	0.2	5.0	4.1
271.9	3968.9	48253.9	-84.3	111645.6	0.1	5.0	5.0
272.9	3965.7	44305.3	-84.4	112036.6	0.2	5.0	6.0
273.9	3955.4	40363.1	-84.4	112423.8	0.5	5.0	7.2
274.9	3936.6	36435.0	-84.5	112806.6	0.7	5.0	8.6
275.9	3908.9	32529.7	-84.5	113184.0	1.0	5.0	9.9
276.9	3872.3	28656.1	-84.5	113555.2	1.3	5.0	11.4
277.9	3826.5	24823.2	-84.6	113919.5	1.6	5.0	12.8
278.9	3770.9	21040.4	-84.6	114276.1	1.9	5.0	14.4
279.9	3705.5	17317.7	-84.7	114623.9	2.2	5.0	15.9
280.9	3630.1	13664.7	-84.7	114962.4	2.5	5.0	17.5
281.9	3545.0	10091.4	-84.8	115290.4	2.8	5.0	18.9
282.9	3450.5	6607.3	-84.8	115607.5	3.1	5.0	20.3
283.9	3347.3	3221.4	-84.9	115912.7	3.3	5.0	21.7
284.8	3238.3	0.0	-84.9	116200.3	3.6	5.0	22.8

TABLE 2

AERODYNAMIC HEATING DATA

Key to Tabulated Data

Case	Item	Material	Thickness(in)	Characteristic Length(in)
1	fin	aluminum	0.060	1.250
2	fin	stainless steel	0.060	1.250
3	fin	stainless steel	0.100	1.250
4	nose cone	carbon steel	0.204	6.032
5	nose cone	carbon steel	0.204	11.422

TABLE 2

TABULATED AERODYNAMIC HEATING DATA

CASE   1

MATERIAL CHARACTERISTICS

$$V(W) = 0.0025 \text{ FT3}$$

A(W) =   1.000 FT2 $I(0) = 505.000$ DEG R
C(W) =   0.224 BTU/LB-DEG F   E(W) =   0.220
R   = 168.599 LB/FT3   L   = 0.0025 FT

X = 0.1040 FT

| TIME | VEL | ALT | M | RN | T(R) | Q (BTU/ | T(X) |
| | | | | | | FT2-SEC) | |
(SEC)	(FT/SEC)	(FT)			(DEG R)		(DEG R)
0.0	0.1	-0.	0.00	66.3	518.69	0.00	505.00
0.1	231.3	11.3	0.21	153395.7	522.65	0.04	505.02
0.2	470.0	45.7	0.42	311447.0	535.06	0.10	505.08
0.3	716.7	104.0	0.64	474272.4	556.76	0.21	505.23
0.4	971.4	186.9	0.87	641565.3	588.63	0.39	505.53
0.5	1234.4	295.3	1.11	813185.4	631.66	0.66	506.07
0.6	1506.0	429.9	1.35	988963.4	686.87	1.04	506.96
0.7	1786.3	591.6	1.60	1168562.6	755.35	9.06	511.34
0.8	2075.6	781.3	1.86	1351742.5	838.28	13.10	523.80
0.9	2374.0	999.9	2.13	1538097.2	936.86	18.30	540.21
1.0	2681.8	1248.2	2.41	1727319.1	1052.42	24.74	562.84
1.1	2999.2	1527.3	2.70	1918987.0	1186.35	32.56	593.04
1.2	3326.3	1838.0	3.00	2112591.5	1340.07	41.86	632.30
1.3	3663.4	2181.3	3.30	2307705.1	1515.16	52.75	682.24
1.4	4010.7	2558.2	3.62	2503799.1	1713.26	65.33	744.59
1.5	4368.3	2969.8	3.95	2700238.1	1936.00	79.66	821.18
1.6	4736.6	3417.0	4.29	2896548.4	2185.34	95.83	913.89
1.7	5115.7	3900.9	4.64	3092021.5	2463.10	113.87	1024.68
1.8	5506.0	4422.6	5.01	3286093.7	2771.46	133.86	1155.54
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	141.78	1302.75
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	141.78	1302.75

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2.9	5427.1	10233.8	5.04	2803713.1	2686.20	38.96	2131.41
3.9	5176.1	15436.1	4.90	2336747.9	2468.52	8.41	2324.97
4.9	4973.3	20415.6	4.80	1962718.2	2296.77	-1.29	2322.94
5.9	4806.5	25213.4	4.73	1657398.2	2157.63	-5.52	2290.23
6.9	4667.3	29860.5	4.69	1404460.1	2042.42	-5.92	2210.14
7.9	4549.5	34380.6	4.66	1192441.0	1945.11	-5.42	2126.13
8.9	4448.9	38792.7	4.59	971854.1	1871.07	-0.88	2068.16
9.9	4363.3	43112.5	4.50	775079.7	1814.63	-0.93	2046.03
10.9	4289.1	47352.9	4.43	621967.0	1766.59	-0.90	2017.48
11.9	4223.7	51523.9	4.36	501696.8	1724.92	-0.86	1990.52
12.9	4165.2	55633.0	4.30	406491.1	1688.20	-0.80	1965.44
13.9	4112.0	59686.2	4.25	330619.9	1655.25	-0.75	1941.71
14.9	4063.0	63688.1	4.19	269823.8	1625.28	-0.69	1919.28
15.9	4017.4	67642.4	4.15	220879.3	1597.70	-0.64	1898.07
16.9	3974.5	71552.2	4.10	181310.3	1572.05	-0.59	1878.01
17.9	3933.7	75419.6	4.06	149203.9	1547.90	-0.55	1859.00
18.9	3894.7	79246.8	4.02	123070.6	1525.06	-0.50	1840.97
19.9	3857.1	83035.1	3.98	101221.4	1504.37	-0.46	1823.84
20.9	3820.8	86785.8	3.91	81722.6	1489.64	-0.42	1807.58
21.9	3785.4	90500.0	3.84	66326.8	1475.56	-0.38	1792.16
22.9	3750.7	94178.6	3.78	54099.6	1461.99	-0.35	1777.48
23.9	3716.8	97822.3	3.72	44338.3	1448.99	-0.32	1763.49
24.9	3683.3	101431.4	3.66	36502.5	1436.32	-0.29	1750.12
25.9	3650.3	105006.7	3.60	30182.6	1424.04	-0.27	1737.31
26.9	3617.6	108548.3	3.55	25060.7	1412.02	-0.25	1725.03
27.9	3585.2	112056.6	3.49	20891.3	1400.28	-0.23	1713.22
28.9	3553.0	115531.8	3.44	17482.5	1388.73	-0.21	1701.85
29.9	3521.1	118974.2	3.39	14684.6	1377.45	-0.20	1690.89
30.9	3489.3	122383.8	3.33	12378.5	1366.32	-0.18	1680.30
31.9	3457.7	125761.0	3.28	10470.8	1355.38	-0.17	1670.06
32.9	3426.2	129105.7	3.24	8886.7	1344.59	-0.16	1660.14
33.9	3394.8	132418.0	3.19	7566.6	1333.95	-0.15	1650.53
34.9	3363.6	135698.2	3.14	6463.1	1323.50	-0.14	1641.20
35.9	3332.4	138946.2	3.09	5537.1	1313.15	-0.13	1632.14
36.9	3301.3	142162.1	3.05	4757.9	1302.93	-0.12	1623.34
37.9	3270.2	145345.9	3.00	4099.9	1292.81	-0.11	1614.76
38.9	3239.3	148497.8	2.96	3542.9	1282.87	-0.11	1606.42
39.9	3208.3	151617.7	2.92	3069.8	1272.98	-0.10	1598.28
40.9	3177.5	154705.7	2.88	2666.9	1263.27	-0.10	1590.35
41.9	3146.7	157761.9	2.84	2354.8	1249.73	-0.09	1582.60
42.9	3115.9	160786.2	2.82	2089.5	1235.30	-0.09	1575.02
43.9	3085.2	163778.7	2.79	1856.0	1221.05	-0.09	1567.60
44.9	3054.6	166739.4	2.76	1650.6	1206.99	-0.08	1560.34
45.9	3024.0	169668.3	2.73	1469.4	1193.08	-0.08	1553.23
46.9	2993.4	172565.4	2.71	1309.6	1179.30	-0.08	1546.26
47.9	2962.9	175430.9	2.68	1169.2	1165.50	-0.07	1539.44
48.9	2932.4	178264.6	2.67	1069.9	1145.16	-0.07	1532.74
49.9	2901.9	181066.7	2.66	978.6	1125.05	-0.07	1526.16
50.9	2871.5	183837.0	2.65	894.9	1105.19	-0.07	1519.70

51.9	2841.2	186575.7	2.64	818.2	1085.60	-0.07	1513.35
52.9	2810.9	189282.7	2.63	747.8	1066.22	-0.07	1507.11
53.9	2780.6	191958.1	2.62	683.2	1047.05	-0.06	1500.98
54.9	2750.4	194601.9	2.61	624.1	1028.15	-0.06	1494.96
55.9	2720.2	197214.0	2.60	569.9	1009.45	-0.06	1489.04
56.9	2690.0	199794.6	2.59	520.3	990.98	-0.06	1483.23
57.9	2659.9	202343.6	2.58	474.9	972.75	-0.06	1477.51
58.9	2629.9	204860.9	2.56	433.3	954.78	-0.05	1471.90
59.9	2599.9	207346.7	2.55	395.3	937.02	-0.05	1466.37
60.9	2569.9	209801.0	2.54	360.6	919.48	-0.05	1460.94
61.9	2540.0	212223.6	2.53	328.8	902.18	-0.05	1455.60
62.9	2510.1	214614.8	2.52	299.8	885.10	-0.05	1450.35
63.9	2480.3	216974.4	2.50	273.3	868.27	-0.05	1445.18
64.9	2450.5	219302.5	2.49	249.0	851.64	-0.04	1440.10
65.9	2420.8	221599.0	2.48	226.9	835.26	-0.04	1435.10
66.9	2391.1	223864.1	2.46	206.7	819.09	-0.04	1430.18
67.9	2361.5	226097.6	2.45	188.3	803.17	-0.04	1425.34
68.9	2332.0	228299.7	2.44	171.5	787.49	-0.04	1420.58
69.9	2302.5	230470.2	2.42	156.2	772.02	-0.04	1415.89
70.9	2273.1	232609.3	2.41	142.3	756.78	-0.03	1411.27
71.9	2243.7	234716.9	2.39	129.5	741.76	-0.03	1406.72
72.9	2214.4	236793.1	2.38	117.9	726.97	-0.03	1402.25
73.9	2185.1	238837.7	2.36	107.4	712.39	-0.03	1397.84
74.9	2156.0	240851.0	2.35	97.8	698.08	-0.03	1393.49
75.9	2126.9	242832.7	2.33	89.0	683.97	-0.03	1389.21
76.9	2097.8	244783.1	2.32	81.0	670.07	-0.03	1384.99
77.9	2068.9	246702.0	2.30	73.8	656.43	-0.02	1380.83
78.9	2040.0	248589.5	2.28	67.2	642.99	-0.02	1376.73
79.9	2011.2	250445.5	2.27	61.2	629.79	-0.02	1372.69
80.9	1982.5	252270.2	2.25	55.7	616.81	-0.02	1368.70
81.9	1953.9	254063.4	2.23	50.7	604.07	-0.02	1364.77
82.9	1925.4	255825.2	2.21	46.2	591.55	-0.02	1360.89
83.9	1897.0	257555.6	2.20	42.1	579.26	-0.02	1357.06
84.9	1868.6	259254.6	2.18	38.4	567.16	-0.02	1353.28
85.9	1840.4	260922.3	2.16	35.0	555.32	-0.02	1349.54
86.9	1812.3	262558.5	2.14	31.8	543.96	-0.02	1345.86
87.9	1784.3	264163.4	2.11	28.4	536.43	-0.01	1342.22
88.9	1756.4	265736.9	2.07	25.4	529.03	-0.01	1338.63
89.9	1728.6	267279.0	2.04	22.7	521.78	-0.01	1335.08
90.9	1701.0	268789.8	2.01	20.4	514.70	-0.01	1331.58
91.9	1673.5	270269.2	1.98	18.3	507.76	-0.01	1328.12
92.9	1646.2	271717.2	1.94	16.5	500.98	-0.01	1324.69
93.9	1618.9	273133.9	1.91	14.9	494.31	-0.01	1321.31
94.9	1591.9	274519.2	1.88	13.4	487.82	-0.01	1317.97
95.9	1565.0	275873.2	1.85	12.2	481.46	-0.01	1314.66
96.9	1538.3	277195.9	1.82	11.0	475.26	-0.01	1311.39
97.9	1511.8	278487.2	1.79	10.0	469.22	-0.01	1308.16
98.9	1485.4	279747.2	1.75	9.1	463.29	-0.01	1304.96
99.9	1459.3	280975.8	1.72	8.3	457.54	-0.01	1301.79

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100.9	1433.4	282173.2	1.69	7.6	451.94	−0.01	1298.66
101.9	1407.6	283339.2	1.66	6.9	446.45	−0.01	1295.56
102.9	1382.2	284473.9	1.63	6.3	441.15	−0.01	1292.50
103.9	1356.9	285577.3	1.60	5.8	435.96	−0.01	1289.46
104.9	1332.0	286649.3	1.57	5.4	430.95	−0.01	1286.46
105.9	1307.3	287690.1	1.54	4.9	426.08	−0.01	1283.48
106.9	1282.9	288699.6	1.51	4.5	421.35	−0.01	1280.54
107.9	1258.8	289677.7	1.49	4.2	416.76	−0.01	1277.62
108.9	1235.0	290624.6	1.46	3.9	412.32	−0.01	1274.73
109.9	1211.6	291540.1	1.43	3.6	408.04	−0.01	1271.87
110.9	1188.6	292424.4	1.40	3.4	403.91	−0.01	1269.04
111.9	1165.9	293277.4	1.38	3.1	399.91	−0.01	1266.23
112.9	1143.6	294099.1	1.35	2.9	396.05	−0.01	1263.45
113.9	1121.8	294889.5	1.32	2.7	392.36	−0.00	1260.70
114.9	1100.4	295648.6	1.30	2.5	388.80	−0.00	1257.97
115.9	1079.5	296376.4	1.27	2.4	385.39	−0.00	1255.26
116.9	1059.2	297073.0	1.25	2.2	382.14	−0.00	1252.58
117.9	1039.3	297738.3	1.23	2.1	379.02	−0.00	1249.92
118.9	1020.1	298372.3	1.20	2.0	376.06	−0.00	1247.29
119.9	1001.4	298975.0	1.18	1.9	373.23	−0.00	1244.68
120.9	983.4	299546.5	1.16	1.8	370.62	−0.00	1242.09
121.9	966.1	300086.7	1.14	1.7	369.24	−0.00	1239.52
122.9	949.5	300595.6	1.12	1.6	367.93	−0.00	1236.98
123.9	933.6	301073.3	1.10	1.5	366.70	−0.00	1234.45
124.9	918.5	301519.7	1.08	1.5	365.55	−0.00	1231.95
125.9	904.3	301934.8	1.06	1.4	364.48	−0.00	1229.47
126.9	890.9	302318.7	1.04	1.3	363.49	−0.00	1227.01
127.9	878.5	302671.3	1.03	1.3	362.60	−0.00	1224.57
128.9	867.0	302992.7	1.01	1.2	361.77	−0.00	1222.14
129.9	856.4	303282.7	1.00	1.2	361.02	−0.00	1219.74
130.9	846.9	303541.6	0.99	1.2	360.35	−0.00	1217.36
131.9	838.5	303769.2	0.98	1.1	359.77	−0.00	1214.99
132.9	831.1	303965.5	0.97	1.1	359.26	−0.00	1212.65
133.9	824.9	304130.5	0.96	1.1	358.84	−0.00	1210.32
134.9	819.8	304264.3	0.95	1.1	358.50	−0.00	1208.01
135.9	815.9	304366.9	0.95	1.1	358.23	−0.00	1205.72
136.9	813.2	304438.2	0.94	1.0	358.06	−0.00	1203.44
137.9	811.6	304478.2	0.94	1.0	357.95	−0.00	1201.19
138.9	811.3	304487.0	0.94	1.0	357.93	−0.00	1198.94
139.9	812.2	304464.5	0.94	1.0	357.99	−0.00	1196.72
140.9	814.2	304410.8	0.95	1.1	358.12	−0.00	1194.51
141.9	817.5	304325.8	0.95	1.1	358.34	−0.00	1192.32

CASE 2

MATERIAL CHARACTERISTICS

$$V(W) = 0.0025 \text{ FT3}$$

A(W) = 1.000 FT2   T(0) = 505.000 DEG R
C(W) = 0.109 BTU/LB-DEG F   E(W) = 0.550
R   = 485.600 LB/FT3   L   = 0.0025 FT

X = 0.1040 FT

TIME	VEL	ALT	M	RN	T(R)	Q (BTU/	T(W)
(SEC)	(FT/SEC)	(FT)			(DEG R)	FT2-SEC)	(DEG R)
0.	0.1	-0.	0.00	66.3	518.69	0.00	505.00
0.1	231.3	11.3	0.21	153395.7	522.65	0.04	505.00
0.2	470.0	45.7	0.42	311447.0	535.06	0.10	505.04
0.3	716.7	104.0	0.64	474272.4	556.76	0.21	505.14
0.4	971.4	186.9	0.87	641565.3	588.63	0.39	505.35
0.5	1234.4	295.3	1.11	813185.4	631.66	0.66	505.73
0.6	1506.0	429.9	1.35	988963.4	686.87	1.05	506.35
0.7	1786.3	591.6	1.60	1168562.6	755.35	9.13	509.48
0.8	2075.6	781.3	1.86	1351742.5	838.28	13.32	518.50
0.9	2374.0	999.9	2.13	1538097.2	936.86	18.75	530.42
1.0	2681.8	1248.2	2.41	1727319.1	1052.42	25.54	547.03
1.1	2999.2	1527.3	2.70	1918987.0	1186.35	33.86	569.35
1.2	3326.3	1838.0	3.00	2112591.5	1340.07	43.85	598.58
1.3	3663.4	2181.3	3.30	2307705.1	1515.16	55.68	636.05
1.4	4010.7	2558.2	3.62	2503799.1	1713.26	69.47	683.17
1.5	4368.3	2969.8	3.95	2700238.4	1936.00	85.36	741.49
1.6	4736.6	3417.0	4.29	2896548.4	2185.34	103.46	812.62
1.7	5115.7	3900.9	4.64	3092021.5	2463.10	123.88	898.27
1.8	5506.0	4422.6	5.01	3286093.7	2771.46	146.72	1000.21
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	157.64	1116.07
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	157.64	1116.07

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2.9	5427.1	10233.8	5.04	2803713.1	2686.20	58.15	1858.10
3.9	5176.1	15436.1	4.90	2336747.9	2468.52	21.20	2106.71
4.9	4973.3	20415.6	4.80	1962718.2	2296.77	6.53	2164.14
5.9	4806.5	25213.4	4.73	1657398.2	2157.63	-0.03	2158.28
6.9	4667.3	29860.5	4.69	1404460.1	2042.42	-2.47	2112.23
7.9	4549.5	34380.6	4.66	1192441.0	1945.11	-3.29	2054.96
8.9	4448.9	38792.7	4.59	971854.1	1871.07	-0.60	2005.74
9.9	4363.3	43112.5	4.50	775079.7	1814.63	-0.64	1974.25
10.9	4289.1	47352.9	4.43	621967.0	1766.59	-0.63	1941.42
11.9	4223.7	51523.9	4.36	501696.8	1724.92	-0.60	1910.42
12.9	4165.2	55633.0	4.30	406491.1	1688.20	-0.56	1881.50
13.9	4112.0	59686.2	4.25	330619.9	1655.25	-0.52	1854.30
14.9	4063.0	63688.1	4.19	269823.8	1625.28	-0.48	1828.68
15.9	4017.4	67642.4	4.15	220879.3	1597.70	-0.44	1804.51
16.9	3974.5	71552.2	4.10	181310.3	1572.05	-0.41	1781.68
17.9	3933.7	75419.6	4.06	149203.9	1547.90	-0.37	1760.06
18.9	3894.7	79246.8	4.02	123070.6	1525.06	-0.34	1739.56
19.9	3857.1	83035.1	3.98	101221.4	1504.37	-0.31	1720.08
20.9	3820.8	86785.8	3.91	81722.6	1489.64	-0.28	1701.56
21.9	3785.4	90500.0	3.84	66326.8	1475.56	-0.25	1683.96
22.9	3750.7	94178.6	3.78	54099.6	1461.99	-0.23	1667.18
23.9	3716.8	97822.3	3.72	44338.3	1448.99	-0.20	1651.16
24.9	3683.3	101431.4	3.66	36502.5	1436.32	-0.19	1635.83
25.9	3650.3	105006.7	3.60	30182.6	1424.04	-0.17	1621.13
26.9	3617.6	108548.3	3.55	25060.7	1412.02	-0.15	1607.03
27.9	3585.2	112056.6	3.49	20891.3	1400.28	-0.14	1593.46
28.9	3553.0	115531.8	3.44	17482.5	1388.73	-0.13	1580.40
29.9	3521.1	118974.2	3.39	14684.6	1377.45	-0.12	1567.80
30.9	3489.3	122383.8	3.33	12378.5	1366.32	-0.11	1555.65
31.9	3457.7	125761.0	3.28	10470.8	1355.38	-0.10	1543.89
32.9	3426.2	129105.7	3.24	8886.7	1344.59	-0.09	1532.52
33.9	3394.8	132418.0	3.19	7566.6	1333.95	-0.09	1521.51
34.9	3363.6	135698.2	3.14	6463.1	1323.50	-0.08	1510.84
35.9	3332.4	138946.2	3.09	5537.1	1313.15	-0.08	1500.48
36.9	3301.3	142162.1	3.05	4757.9	1302.93	-0.07	1490.42
37.9	3270.2	145345.9	3.00	4099.9	1292.81	-0.07	1480.65
38.9	3239.3	148497.8	2.96	3542.9	1282.87	-0.06	1471.14
39.9	3208.3	151617.7	2.92	3069.8	1272.98	-0.06	1461.90
40.9	3177.5	154705.7	2.88	2666.9	1263.27	-0.06	1452.89
41.9	3146.7	157761.9	2.84	2354.8	1249.73	-0.05	1444.11
42.9	3115.9	160786.2	2.82	2089.5	1235.30	-0.05	1435.55
43.9	3085.2	163778.7	2.79	1856.0	1221.05	-0.05	1427.18
44.9	3054.6	166739.4	2.76	1650.6	1206.99	-0.05	1419.01
45.9	3024.0	169668.3	2.73	1469.4	1193.08	-0.05	1411.03
46.9	2993.4	172565.4	2.71	1309.6	1179.30	-0.05	1403.22
47.9	2962.9	175430.9	2.68	1169.2	1165.50	-0.05	1395.59
48.9	2932.4	178264.6	2.67	1069.9	1145.16	-0.05	1388.13
49.9	2901.9	181066.7	2.66	978.6	1125.05	-0.04	1380.81
50.9	2871.5	183837.0	2.65	894.9	1105.19	-0.04	1373.64

51.9	2841.2	186575.7	2.64	818.2	1085.60	−0.04	1366.61
52.9	2810.9	189282.7	2.63	747.8	1066.22	−0.04	1359.72
53.9	2780.6	191958.1	2.62	683.2	1047.05	−0.04	1352.97
54.9	2750.4	194601.9	2.61	624.1	1028.15	−0.04	1346.35
55.9	2720.2	197214.0	2.60	569.9	1009.45	−0.04	1339.85
56.9	2690.0	199794.6	2.59	520.3	990.98	−0.04	1333.48
57.9	2659.9	202343.6	2.58	474.9	972.75	−0.04	1327.23
58.9	2629.9	204860.9	2.56	433.3	954.78	−0.04	1321.10
59.9	2599.9	207346.7	2.55	395.3	937.02	−0.04	1315.08
60.9	2569.9	209801.0	2.54	360.6	919.48	−0.04	1309.17
61.9	2540.0	212223.6	2.53	328.8	902.18	−0.04	1303.37
62.9	2510.1	214614.8	2.52	299.8	885.10	−0.03	1297.68
63.9	2480.3	216974.4	2.50	273.3	868.27	−0.03	1292.08
64.9	2450.5	219302.5	2.49	249.0	851.64	−0.03	1286.58
65.9	2420.8	221599.0	2.48	226.9	835.26	−0.03	1281.18
66.9	2391.1	223864.1	2.46	206.7	819.09	−0.03	1275.88
67.9	2361.5	226097.6	2.45	188.3	803.17	−0.03	1270.66
68.9	2332.0	228299.7	2.44	171.5	787.49	−0.03	1265.54
69.9	2302.5	230470.2	2.42	156.2	772.02	−0.03	1260.50
70.9	2273.1	232609.3	2.41	142.3	756.78	−0.03	1255.54
71.9	2243.7	234716.9	2.39	129.5	741.76	−0.02	1250.67
72.9	2214.4	236793.1	2.38	117.9	726.97	−0.02	1245.87
73.9	2185.1	238837.7	2.36	107.4	712.39	−0.02	1241.16
74.9	2156.0	240851.0	2.35	97.8	698.08	−0.02	1236.52
75.9	2126.9	242832.7	2.33	89.0	683.97	−0.02	1231.95
76.9	2097.8	244783.1	2.32	81.0	670.07	−0.02	1227.45
77.9	2068.9	246702.0	2.30	73.8	656.43	−0.02	1223.02
78.9	2040.0	248589.5	2.28	67.2	642.99	−0.02	1218.66
79.9	2011.2	250445.5	2.27	61.2	629.79	−0.02	1214.37
80.9	1982.5	252270.2	2.25	55.7	616.81	−0.02	1210.14
81.9	1953.9	254063.4	2.23	50.7	604.07	−0.02	1205.97
82.9	1925.4	255825.2	2.21	46.2	591.55	−0.02	1201.86
83.9	1897.0	257555.6	2.20	42.1	579.26	−0.01	1197.81
84.9	1868.6	259254.6	2.18	38.4	567.16	−0.01	1193.82
85.9	1840.4	260922.3	2.16	35.0	555.32	−0.01	1189.88
86.9	1812.3	262558.5	2.14	31.8	543.96	−0.01	1186.00
87.9	1784.3	264163.4	2.11	28.4	536.43	−0.01	1182.18
88.9	1756.4	265736.9	2.07	25.4	529.03	−0.01	1178.40
89.9	1728.6	267279.0	2.04	22.7	521.78	−0.01	1174.68
90.9	1701.0	268789.8	2.01	20.4	514.70	−0.01	1171.01
91.9	1673.5	270269.2	1.98	18.3	507.76	−0.01	1167.38
92.9	1646.2	271717.2	1.94	16.5	500.98	−0.01	1163.80
93.9	1618.9	273133.9	1.91	14.9	494.31	−0.01	1160.27
94.9	1591.9	274519.2	1.88	13.4	487.82	−0.01	1156.78
95.9	1565.0	275873.2	1.85	12.2	481.46	−0.01	1153.34
96.9	1538.3	277195.9	1.82	11.0	475.26	−0.01	1149.94
97.9	1511.8	278487.2	1.79	10.0	469.22	−0.01	1146.58
98.9	1485.4	279747.2	1.75	9.1	463.29	−0.01	1143.26
99.9	1459.3	280975.8	1.72	8.3	457.54	−0.01	1139.98

100.9	1433.4	282173.2	1.69	7.6	451.94	-0.01	1136.74
101.9	1407.6	283339.2	1.66	6.9	446.45	-0.01	1133.54
102.9	1382.2	284473.9	1.63	6.3	441.15	-0.01	1130.37
103.9	1356.9	285577.3	1.60	5.8	435.96	-0.01	1127.24
104.9	1332.0	286649.3	1.57	5.4	430.95	-0.01	1124.15
105.9	1307.3	287690.1	1.54	4.9	426.08	-0.01	1121.09
106.9	1282.9	288699.6	1.51	4.5	421.35	-0.01	1118.07
107.9	1258.8	289677.7	1.49	4.2	416.76	-0.00	1115.08
108.9	1235.0	290624.6	1.46	3.9	412.32	-0.00	1112.12
109.9	1211.6	291540.1	1.43	3.6	408.04	-0.00	1109.19
110.9	1188.6	292424.4	1.40	3.4	403.91	-0.00	1106.30
111.9	1165.9	293277.4	1.38	3.1	399.91	-0.00	1103.43
112.9	1143.6	294099.1	1.35	2.9	396.05	-0.00	1100.60
113.9	1121.8	294889.5	1.32	2.7	392.36	-0.00	1097.80
114.9	1100.4	295648.6	1.30	2.5	388.80	-0.00	1095.02
115.9	1079.5	296376.4	1.27	2.4	385.39	-0.00	1092.27
116.9	1059.2	297073.0	1.25	2.2	382.14	-0.00	1089.56
117.9	1039.3	297738.3	1.23	2.1	379.02	-0.00	1086.86
118.9	1020.1	298372.3	1.20	2.0	376.06	-0.00	1084.20
119.9	1001.4	298975.0	1.18	1.9	373.23	-0.00	1081.56
120.9	983.4	299546.5	1.16	1.8	370.62	-0.00	1078.95
121.9	966.1	300086.7	1.14	1.7	369.24	-0.00	1076.36
122.9	949.5	300595.6	1.12	1.6	367.93	-0.00	1073.80
123.9	933.6	301073.3	1.10	1.5	366.70	-0.00	1071.27
124.9	918.5	301519.7	1.08	1.5	365.55	-0.00	1068.75
125.9	904.3	301934.8	1.06	1.4	364.48	-0.00	1066.26
126.9	890.9	302318.7	1.04	1.3	363.49	-0.00	1063.80
127.9	878.5	302671.3	1.03	1.3	362.60	-0.00	1061.36
128.9	867.0	302992.7	1.01	1.2	361.77	-0.00	1058.93
129.9	856.4	303282.7	1.00	1.2	361.02	-0.00	1056.54
130.9	846.9	303541.6	0.99	1.2	360.35	-0.00	1054.16
131.9	838.5	303769.2	0.98	1.1	359.77	-0.00	1051.80
132.9	831.1	303965.5	0.97	1.1	359.26	-0.00	1049.47
133.9	824.9	304130.5	0.96	1.1	358.84	-0.00	1047.16
134.9	819.8	304264.3	0.95	1.1	358.50	-0.00	1044.86
135.9	815.9	304366.9	0.95	1.1	358.23	-0.00	1042.59
136.9	813.2	304438.2	0.94	1.0	358.06	-0.00	1040.34
137.9	811.6	304478.2	0.94	1.0	357.95	-0.00	1038.10
138.9	811.3	304487.0	0.94	1.0	357.93	-0.00	1035.89
139.9	812.2	304464.5	0.94	1.0	357.99	-0.00	1033.69
140.9	814.2	304410.8	0.95	1.1	358.12	-0.00	1031.51
141.9	817.5	304325.8	0.95	1.1	358.34	-0.00	1029.35

CASE 3

MATERIAL CHARACTERISTICS

$$V(W) = 000.0042 \text{ FT3}$$

A(W) =   1.000 FT2   T(0) = 505.000 DEG R
C(W) =   0.109 BTU/LB-DEG F   E(W) =   0.550
R   =   485.600 LB/FT3   L   =   0.0042 FT

X =   0.1040 FT

TIME	VEL	ALT	M	RN	T(R)	Q (BTU/	T(W)
(SEC)	(FT/SEC)	(FT)			(DEG R)	FT2-SEC)	(DEG R)
.0	0.1	-0.	0.00	66.3	518.69	0.00	505.00
0.1	231.3	11.3	0.21	153395.7	522.65	0.04	505.00
0.2	470.0	45.7	0.42	311447.0	535.06	0.10	505.03
0.3	716.7	104.0	0.64	474272.4	556.76	0.21	505.08
0.4	971.4	186.9	0.87	641565.3	588.63	0.39	505.21
0.5	1234.4	295.3	1.11	813185.4	631.66	0.66	505.43
0.6	1506.0	429.9	1.35	988963.4	686.87	1.05	505.81
0.7	1786.3	591.6	1.60	1168562.6	755.35	9.19	507.68
0.8	2075.6	781.3	1.86	1351742.5	838.28	13.54	513.12
0.9	2374.0	999.9	2.13	1538097.2	936.86	19.21	520.36
1.0	2681.8	1248.2	2.41	1727319.1	1052.42	26.37	530.53
1.1	2999.2	1527.3	2.70	1918987.0	1186.35	35.23	544.31
1.2	3326.3	1838.0	3.00	2112591.5	1340.07	45.99	562.49
1.3	3663.4	2181.3	3.30	2307705.1	1515.16	58.85	585.98
1.4	4010.7	2558.2	3.62	2503799.1	1713.26	74.02	615.76
1.5	4368.3	2969.8	3.95	2700238.1	1936.00	91.69	652.91
1.6	4736.6	3417.0	4.29	2896548.4	2185.34	112.05	698.61
1.7	5115.7	3900.9	4.64	3092021.5	2463.10	135.29	754.10
1.8	5506.0	4422.6	5.01	3286093.7	2771.46	161.59	820.71
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	176.23	897.30
1.9	5744.8	4752.8	5.23	3401186.7	2971.33	176.23	897.30

2.9	5427.1	10233.8	5.04	2803713.1	2686.20	86.02	1461.27
3.9	5176.1	15436.1	4.90	2336747.9	2468.52	43.04	1733.85
4.9	4973.3	20415.6	4.80	1962718.2	2296.77	21.40	1862.14
5.9	4806.5	25213.4	4.73	1657398.2	2157.63	9.96	1918.47
6.9	4667.3	29860.5	4.69	1404460.1	2042.42	3.84	1933.54
7.9	4549.5	34380.6	4.66	1192441.0	1945.11	0.53	1927.37
8.9	4448.9	38792.7	4.59	971854.1	1871.07	-0.18	1911.93
9.9	4363.3	43112.5	4.50	775079.7	1814.63	-0.33	1896.05
10.9	4289.1	47352.9	4.43	621967.0	1766.59	-0.41	1880.19
11.9	4223.7	51523.9	4.36	501696.8	1724.92	-0.45	1864.33
12.9	4165.2	55633.0	4.30	406491.1	1688.20	-0.47	1848.84
13.9	4112.0	59686.2	4.25	330619.9	1655.25	-0.47	1833.74
14.9	4063.0	63688.1	4.19	269823.8	1625.28	-0.46	1819.08
15.9	4017.4	67642.4	4.15	220879.3	1597.70	-0.44	1804.86
16.9	3974.5	71552.2	4.10	181310.3	1572.05	-0.42	1791.10
17.9	3933.7	75419.6	4.06	149203.9	1547.90	-0.40	1777.77
18.9	3894.7	79246.8	4.02	123070.6	1525.06	-0.38	1764.87
19.9	3857.1	83035.1	3.98	101221.4	1504.37	-0.36	1752.39
20.9	3820.8	86785.8	3.91	81722.6	1489.64	-0.33	1740.31
21.9	3785.4	90500.0	3.84	66326.8	1475.56	-0.31	1728.65
22.9	3750.7	94178.6	3.78	54099.6	1461.99	-0.28	1717.36
23.9	3716.8	97822.3	3.72	44338.3	1448.99	-0.26	1706.43
24.9	3683.3	101431.4	3.66	36502.5	1436.32	-0.24	1695.84
25.9	3650.3	105006.7	3.60	30182.6	1424.04	-0.22	1685.55
26.9	3617.6	108548.3	3.55	25060.7	1412.02	-0.21	1675.57
27.9	3585.2	112056.6	3.49	20891.3	1400.28	-0.19	1665.86
28.9	3553.0	115531.8	3.44	17482.5	1388.73	-0.18	1656.41
29.9	3521.1	118974.2	3.39	14684.6	1377.45	-0.17	1647.21
30.9	3489.3	122383.8	3.33	12378.5	1366.32	-0.16	1638.25
31.9	3457.7	125761.0	3.28	10470.8	1355.38	-0.15	1629.51
32.9	3426.2	129105.7	3.24	8886.7	1344.59	-0.14	1620.98
33.9	3394.8	132418.0	3.19	7566.6	1333.95	-0.13	1612.65
34.9	3363.6	135698.2	3.14	6463.1	1323.50	-0.12	1604.51
35.9	3332.4	138946.2	3.09	5537.1	1313.15	-0.12	1596.56
36.9	3301.3	142162.1	3.05	4757.9	1302.93	-0.11	1588.78
37.9	3270.2	145345.9	3.00	4099.9	1292.81	-0.10	1581.17
38.9	3239.3	148497.8	2.96	3542.9	1282.87	-0.10	1573.71
39.9	3208.3	151617.7	2.92	3069.8	1272.98	-0.09	1566.42
40.9	3177.5	154705.7	2.88	2666.9	1263.27	-0.09	1559.27
41.9	3146.7	157761.9	2.84	2354.8	1249.73	-0.08	1552.26
42.9	3115.9	160786.2	2.82	2089.5	1235.30	-0.08	1545.38
43.9	3085.2	163778.7	2.79	1856.0	1221.05	-0.08	1538.63
44.9	3054.6	166739.4	2.76	1650.6	1206.99	-0.08	1532.00
45.9	3024.0	169668.3	2.73	1469.4	1193.08	-0.07	1525.49
46.9	2993.4	172565.4	2.71	1309.6	1179.30	-0.07	1519.09
47.9	2962.9	175430.9	2.68	1169.2	1165.50	-0.07	1512.81
48.9	2932.4	178264.6	2.67	1069.9	1145.16	-0.07	1506.63
49.9	2901.9	181066.7	2.66	978.6	1125.05	-0.07	1500.55
50.9	2871.5	183837.0	2.65	894.9	1105.19	-0.06	1494.57

51.9	2841.2	186575.7	2.64	818.2	1085.60	−0.06	1488.69
52.9	2810.9	189282.7	2.63	747.8	1066.22	−0.06	1482.90
53.9	2780.6	191958.1	2.62	683.2	1047.05	−0.06	1477.20
54.9	2750.4	194601.9	2.61	624.1	1028.15	−0.06	1471.59
55.9	2720.2	197214.0	2.60	569.9	1009.45	−0.06	1466.07
56.9	2690.0	199794.6	2.59	520.3	990.98	−0.06	1460.64
57.9	2659.9	202343.6	2.58	474.9	972.75	−0.05	1455.28
58.9	2629.9	204860.9	2.56	433.3	954.78	−0.05	1450.01
59.9	2599.9	207346.7	2.55	395.3	937.02	−0.05	1444.82
60.9	2569.9	209801.0	2.54	360.6	919.48	−0.05	1439.71
61.9	2540.0	212223.6	2.53	328.8	902.18	−0.05	1434.67
62.9	2510.1	214614.8	2.52	299.8	885.10	−0.05	1429.71
63.9	2480.3	216974.4	2.50	273.3	868.27	−0.04	1424.81
64.9	2450.5	219302.5	2.49	249.0	851.64	−0.04	1419.99
65.9	2420.8	221599.0	2.48	226.9	835.26	−0.04	1415.24
66.9	2391.1	223864.1	2.46	206.7	819.09	−0.04	1410.56
67.9	2361.5	226097.6	2.45	188.3	803.17	−0.04	1405.94
68.9	2332.0	228299.7	2.44	171.5	787.49	−0.04	1401.39
69.9	2302.5	230470.2	2.42	156.2	772.02	−0.03	1396.90
70.9	2273.1	232609.3	2.41	142.3	756.78	−0.03	1392.47
71.9	2243.7	234716.9	2.39	129.5	741.76	−0.03	1388.10
72.9	2214.4	236793.1	2.38	117.9	726.97	−0.03	1383.79
73.9	2185.1	238837.7	2.36	107.4	712.39	−0.03	1379.54
74.9	2156.0	240851.0	2.35	97.8	698.08	−0.03	1375.34
75.9	2126.9	242832.7	2.33	89.0	683.97	−0.03	1371.20
76.9	2097.8	244783.1	2.32	81.0	670.07	−0.02	1367.11
77.9	2068.9	246702.0	2.30	73.8	656.43	−0.02	1363.08
78.9	2040.0	248589.5	2.28	67.2	642.99	−0.02	1359.09
79.9	2011.2	250445.5	2.27	61.2	629.79	−0.02	1355.16
80.9	1982.5	252270.2	2.25	55.7	616.81	−0.02	1351.27
81.9	1953.9	254063.4	2.23	50.7	604.07	−0.02	1347.43
82.9	1925.4	255825.2	2.21	46.2	591.55	−0.02	1343.64
83.9	1897.0	257555.6	2.20	42.1	579.26	−0.02	1339.89
84.9	1868.6	259254.6	2.18	38.4	567.16	−0.02	1336.19
85.9	1840.4	260922.3	2.16	35.0	555.32	−0.02	1332.53
86.9	1812.3	262558.5	2.14	31.8	543.96	−0.02	1328.92
87.9	1784.3	264163.4	2.11	28.4	536.43	−0.01	1325.34
88.9	1756.4	265736.9	2.07	25.4	529.03	−0.01	1321.81
89.9	1728.6	267279.0	2.04	22.7	521.78	−0.01	1318.31
90.9	1701.0	268789.8	2.01	20.4	514.70	−0.01	1314.86
91.9	1673.5	270269.2	1.98	18.3	507.76	−0.01	1311.44
92.9	1646.2	271717.2	1.94	16.5	500.98	−0.01	1308.06
93.9	1618.9	273133.9	1.91	14.9	494.31	−0.01	1304.72
94.9	1591.9	274519.2	1.88	13.4	487.82	−0.01	1301.41
95.9	1565.0	275873.2	1.85	12.2	481.46	−0.01	1298.14
96.9	1538.3	277195.9	1.82	11.0	475.26	−0.01	1294.90
97.9	1511.8	278487.2	1.79	10.0	469.22	−0.01	1291.70
98.9	1485.4	279747.2	1.75	9.1	463.29	−0.01	1288.52
99.9	1459.3	280975.8	1.72	8.3	457.54	−0.01	1285.38

100.9	1433.4	282173.2	1.69	7.6	451.94	−0.01	1282.28
101.9	1407.6	283339.2	1.66	6.9	446.45	−0.01	1279.20
102.9	1382.2	284473.9	1.63	6.3	441.15	−0.01	1276.15
103.9	1356.9	285577.3	1.60	5.8	435.96	−0.01	1273.14
104.9	1332.0	286649.3	1.57	5.4	430.95	−0.01	1270.15
105.9	1307.3	287690.1	1.54	4.9	426.08	−0.01	1267.19
106.9	1282.9	288699.6	1.51	4.5	421.35	−0.01	1264.26
107.9	1258.8	289677.7	1.49	4.2	416.76	−0.01	1261.36
108.9	1235.0	290624.6	1.46	3.9	412.32	−0.01	1258.48
109.9	1211.6	291540.1	1.43	3.6	408.04	−0.01	1255.63
110.9	1188.6	292424.4	1.40	3.4	403.91	−0.01	1252.81
111.9	1165.9	293277.4	1.38	3.1	399.91	−0.01	1250.01
112.9	1143.6	294099.1	1.35	2.9	396.05	−0.01	1247.24
113.9	1121.8	294889.5	1.32	2.7	392.36	−0.00	1244.49
114.9	1100.4	295648.6	1.30	2.5	388.80	−0.00	1241.77
115.9	1079.5	296376.4	1.27	2.4	385.39	−0.00	1239.08
116.9	1059.2	297073.0	1.25	2.2	382.14	−0.00	1236.40
117.9	1039.3	297738.3	1.23	2.1	379.02	−0.00	1233.75
118.9	1020.1	298372.3	1.20	2.0	376.06	−0.00	1231.12
119.9	1001.4	298975.0	1.18	1.9	373.23	−0.00	1228.52
120.9	983.4	299546.5	1.16	1.8	370.62	−0.00	1225.94
121.9	966.1	300086.7	1.14	1.7	369.24	−0.00	1223.37
122.9	949.5	300595.6	1.12	1.6	367.93	−0.00	1220.83
123.9	933.6	301073.3	1.10	1.5	366.70	−0.00	1218.32
124.9	918.5	301519.7	1.08	1.5	365.55	−0.00	1215.82
125.9	904.3	301934.8	1.06	1.4	364.48	−0.00	1213.34
126.9	890.9	302318.7	1.04	1.3	363.49	−0.00	1210.89
127.9	878.5	302671.3	1.03	1.3	362.60	−0.00	1208.45
128.9	867.0	302992.7	1.01	1.2	361.77	−0.00	1206.03
129.9	856.4	303282.7	1.00	1.2	361.02	−0.00	1203.64
130.9	846.9	303541.6	0.99	1.2	360.35	−0.00	1201.26
131.9	838.5	303769.2	0.98	1.1	359.77	−0.00	1198.90
132.9	831.1	303965.5	0.97	1.1	359.26	−0.00	1196.56
133.9	824.9	304130.5	0.96	1.1	358.84	−0.00	1194.23
134.9	819.8	304264.3	0.95	1.1	358.50	−0.00	1191.93
135.9	815.9	304366.9	0.95	1.1	358.23	−0.00	1189.64
136.9	813.2	304438.2	0.94	1.0	358.06	−0.00	1187.37
137.9	811.6	304478.2	0.94	1.0	357.95	−0.00	1185.12
138.9	811.3	304487.0	0.94	1.0	357.93	−0.00	1182.88
139.9	812.2	304464.5	0.94	1.0	357.99	−0.00	1180.67
140.9	814.2	304410.8	0.95	1.1	358.12	−0.00	1178.46
141.9	817.5	304325.8	0.95	1.1	358.34	−0.00	1176.28

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CASE 4

MATERIAL CHARACTERISTICS

$$V(W) = 0.017C \text{ FT3}$$

A(W) =	1.000 FT2	T(0) = 505.000 DEG R
C(W) =	0.109 BTU/LB-DEG F	E(W) = 0.350
R =	485.500 LB/FT3	L = 0.0170 FT

X = 0.5026 FT

TIME	VEL	ALT	M	RN	T(R)	Q (BTU/ FT2-SEC)	T(W)
(SEC)	(FT/SEC)	(FT)			(DEG R)		(DEG R)
0.	0.1	-0.	0.00	320.6	518.69	0.00	505.00
0.1	231.3	11.3	0.21	741314.4	522.65	0.06	505.00
0.2	470.0	45.7	0.42	1505127.3	535.06	0.65	505.04
0.3	716.7	104.0	0.64	2292012.4	556.76	1.56	505.16
0.4	971.4	186.9	0.87	3100487.9	588.63	3.20	505.41
0.5	1234.4	295.3	1.11	3929875.0	631.66	5.84	505.91
0.6	1506.0	429.9	1.35	4779356.1	686.87	9.78	506.76
0.7	1786.3	591.6	1.60	5647303.3	755.35	15.32	508.14
0.8	2075.6	781.3	1.86	6532555.7	838.28	22.81	510.23
0.9	2374.0	999.9	2.13	7433150.8	936.86	32.62	513.29
1.0	2681.8	1248.2	2.41	8347602.0	1052.42	45.12	517.58
1.1	2999.2	1527.3	2.70	9273873.9	1186.35	60.73	523.44
1.2	3326.3	1838.0	3.00	10209504.7	1340.07	79.87	531.21
1.3	3663.4	2181.3	3.30	11152428.7	1515.16	102.97	541.34
1.4	4010.7	2558.2	3.62	12100090.9	1713.26	130.50	554.27
1.5	4368.3	2969.8	3.95	13049419.9	1936.00	162.90	570.53
1.6	4736.6	3417.0	4.29	13998127.2	2185.34	200.65	590.68
1.7	5115.7	3900.9	4.64	14942788.5	2463.10	244.21	615.34
1.8	5506.0	4422.6	5.01	15880679.6	2771.46	294.06	645.20
1.9	5744.8	4752.8	5.23	16436889.2	2971.33	325.06	679.89
1.9	5744.8	4752.8	5.23	16436889.2	2971.33	325.06	679.89
2.9	5427.1	10233.8	5.04	13549482.7	2686.20	201.52	967.35
3.9	5176.1	15436.1	4.90	11292783.5	2468.52	129.14	1148.19
4.9	4973.3	20415.6	4.80	9485213.0	2296.77	84.79	1265.15
5.9	4806.5	25213.4	4.73	8009695.6	2157.63	56.66	1342.44
6.9	4667.3	29860.5	4.69	6787323.5	2042.42	38.23	1394.01
7.9	4549.5	34380.6	4.66	5762700.7	1945.11	25.82	1428.53
8.9	4448.9	38792.7	4.59	4696671.6	1871.07	17.52	1451.58
9.9	4363.3	43112.5	4.50	3745721.8	1814.63	12.11	1467.03
10.9	4289.1	47352.9	4.43	3005775.2	1766.59	8.45	1477.52
11.9	4223.7	51523.9	4.36	2424546.5	1724.92	5.91	1484.57
12.9	4165.2	55633.0	4.30	1964446.6	1688.20	4.14	1489.23
13.9	4112.0	59686.2	4.25	1597784.2	1655.25	2.87	1492.22
14.9	4063.0	63688.1	4.19	1303975.3	1625.28	1.97	1494.00
15.9	4017.4	67642.4	4.15	1067441.5	1597.70	1.31	1494.91
16.9	3974.5	71552.2	4.10	876216.7	1572.05	0.23	1494.96
17.9	3933.7	75419.6	4.06	721056.4	1547.90	0.15	1494.13
18.9	3894.7	79246.8	4.02	594762.2	1525.06	0.08	1493.41
19.9	3857.1	83035.1	3.98	489171.9	1504.37	0.03	1492.58
20.9	3820.8	86785.8	3.91	394940.0	1489.64	-0.00	1491.71
21.9	3785.4	90500.0	3.84	320537.2	1475.56	-0.03	1490.82
22.9	3750.7	94178.6	3.78	261446.5	1461.99	-0.05	1489.89
23.9	3716.8	97822.3	3.72	214273.2	1448.99	-0.06	1488.96
24.9	3683.3	101431.4	3.66	176405.5	1436.32	-0.08	1488.01
25.9	3650.3	105006.7	3.60	145863.2	1424.04	-0.08	1487.05
26.9	3617.6	108548.3	3.55	121110.6	1412.02	-0.09	1486.08
27.9	3585.2	112056.6	3.49	100961.3	1400.28	-0.10	1485.11
28.9	3553.0	115531.8	3.44	84487.7	1388.73	-0.10	1484.13
29.9	3521.1	118974.2	3.39	70966.4	1377.45	-0.10	1483.16
30.9	3489.3	122383.8	3.33	59821.6	1366.32	-0.11	1482.18

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31.9	3457.7	125761.0	3.28	50602.1	1355.38	-0.11	1481.21
32.9	3426.2	129105.7	3.24	42946.5	1344.59	-0.11	1480.24
33.9	3394.8	132418.0	3.19	36567.2	1333.95	-0.11	1479.27
34.9	3363.6	135698.2	3.14	31234.0	1323.50	-0.11	1478.30
35.9	3332.4	138946.2	3.09	26759.2	1313.15	-0.11	1477.33
36.9	3301.3	142162.1	3.05	22993.3	1302.93	-0.10	1476.37
37.9	3270.2	145345.9	3.00	19813.7	1292.81	-0.10	1475.41
38.9	3239.3	148497.8	2.96	17121.9	1282.87	-0.10	1474.46
39.9	3208.3	151617.7	2.92	14835.2	1272.98	-0.10	1473.51
40.9	3177.5	154705.7	2.88	12888.3	1263.27	-0.10	1472.56
41.9	3146.7	157761.9	2.84	11380.2	1249.73	-0.10	1471.62
42.9	3115.9	160786.2	2.82	10097.7	1235.30	-0.10	1470.68
43.9	3085.2	163778.7	2.79	8969.7	1221.05	-0.10	1469.74
44.9	3054.6	166739.4	2.76	7976.7	1206.99	-0.10	1468.80
45.9	3024.0	169668.3	2.73	7101.2	1193.08	-0.10	1467.87
46.9	2993.4	172565.4	2.71	6328.7	1179.30	-0.09	1466.94
47.9	2962.9	175430.9	2.68	5650.6	1165.50	-0.09	1466.01
48.9	2932.4	178264.6	2.67	5170.4	1145.16	-0.09	1465.09
49.9	2901.9	181066.7	2.66	4729.4	1125.05	-0.09	1464.17
50.9	2871.5	183837.0	2.65	4324.9	1105.19	-0.09	1463.25
51.9	2841.2	186575.7	2.64	3953.9	1085.60	-0.09	1462.33
52.9	2810.9	189282.7	2.63	3613.6	1066.22	-0.09	1461.41
53.9	2788.6	191958.1	2.62	3301.7	1047.05	-0.09	1460.50
54.9	2750.4	194601.9	2.61	3015.9	1028.15	-0.09	1459.60
55.9	2720.2	197214.0	2.60	2754.1	1009.45	-0.09	1458.69
56.9	2690.0	199794.6	2.59	2514.3	990.98	-0.09	1457.79
57.9	2659.9	202343.6	2.58	2294.9	972.75	-0.08	1456.89
58.9	2629.9	204860.9	2.56	2094.2	954.78	-0.08	1456.00
59.9	2599.9	207346.7	2.55	1910.5	937.02	-0.08	1455.11
60.9	2569.9	209801.0	2.54	1742.5	919.48	-0.08	1454.23
61.9	2540.0	212223.6	2.53	1589.0	902.18	-0.08	1453.35
62.9	2510.1	214614.8	2.52	1448.7	885.10	-0.07	1452.47
63.9	2480.3	216974.4	2.50	1320.6	868.27	-0.07	1451.60
64.9	2450.5	219302.5	2.49	1203.5	851.64	-0.07	1450.73
65.9	2420.8	221599.0	2.48	1096.7	835.26	-0.07	1449.87
66.9	2391.1	223864.1	2.46	999.1	819.09	-0.07	1449.01
67.9	2361.5	226097.6	2.45	910.2	803.17	-0.06	1448.16
68.9	2332.0	228299.7	2.44	829.0	787.49	-0.06	1447.31
69.9	2302.5	230470.2	2.42	755.0	772.02	-0.06	1446.46
70.9	2273.1	232609.3	2.41	687.5	756.78	-0.06	1445.62
71.9	2243.7	234716.9	2.39	626.0	741.76	-0.05	1444.79
72.9	2214.4	236793.1	2.38	570.0	726.97	-0.05	1443.95
73.9	2185.1	238837.7	2.36	519.0	712.39	-0.05	1443.13
74.9	2156.0	240851.0	2.35	472.5	698.08	-0.05	1442.30
75.9	2126.9	242832.7	2.33	430.2	683.97	-0.05	1441.48
76.9	2097.8	244783.1	2.32	391.6	670.07	-0.04	1440.67
77.9	2068.9	246702.0	2.30	356.6	656.43	-0.04	1439.85
78.9	2040.0	248589.5	2.28	324.6	642.99	-0.04	1439.05
79.9	2011.2	250445.5	2.27	295.6	629.79	-0.04	1438.24
80.9	1982.5	252270.2	2.25	269.2	616.81	-0.04	1437.44
81.9	1953.9	254063.4	2.23	245.2	604.07	-0.03	1436.64
82.9	1925.4	255825.2	2.21	223.3	591.55	-0.03	1435.85
83.9	1897.0	257555.6	2.20	203.5	579.26	-0.03	1435.06
84.9	1868.6	259254.6	2.18	185.4	567.16	-0.03	1434.27
85.9	1840.4	260922.3	2.16	169.0	555.32	-0.03	1433.49
86.9	1812.3	262558.5	2.14	153.8	543.96	-0.03	1432.70
87.9	1784.3	264163.4	2.11	137.3	536.43	-0.03	1431.93
88.9	1756.4	265736.9	2.07	122.7	529.03	-0.02	1431.15
89.9	1728.6	267279.0	2.04	109.9	521.78	-0.02	1430.38
90.9	1701.0	268789.8	2.01	98.5	514.70	-0.02	1429.61
91.9	1673.5	270269.2	1.98	88.6	507.76	-0.02	1428.84
92.9	1646.2	271717.2	1.94	79.7	500.98	-0.02	1428.08
93.9	1618.9	273133.9	1.91	71.9	494.31	-0.02	1427.32
94.9	1591.9	274519.2	1.88	64.9	487.82	-0.02	1426.56
95.9	1565.0	275873.2	1.85	58.8	481.46	-0.02	1425.80
96.9	1538.3	277195.9	1.82	53.3	475.26	-0.02	1425.05

97.9	1511.8	278487.2	1.79	48.4	469.22	−0.02	1424.30
98.9	1485.4	279747.2	1.75	44.0	463.29	−0.02	1423.55
99.9	1459.3	280975.8	1.72	40.1	457.54	−0.02	1422.80
100.9	1433.4	282173.2	1.69	36.6	451.94	−0.01	1422.06
101.9	1407.6	283339.2	1.66	33.5	446.45	−0.01	1421.32
102.9	1382.2	284473.9	1.63	30.7	441.15	−0.01	1420.58
103.9	1356.9	285577.3	1.60	28.1	435.96	−0.01	1419.84
104.9	1332.0	286649.3	1.57	25.9	430.95	−0.01	1419.10
105.9	1307.3	287690.1	1.54	23.8	426.08	−0.01	1418.37
106.9	1282.9	288699.6	1.51	22.0	421.35	−0.01	1417.64
107.9	1258.8	289677.7	1.49	20.3	416.76	−0.01	1416.91
108.9	1235.0	290624.6	1.46	18.8	412.32	−0.01	1416.18
109.9	1211.6	291540.1	1.43	17.4	408.04	−0.01	1415.45
110.9	1188.6	292424.4	1.40	16.2	403.91	−0.01	1414.73
111.9	1165.9	293277.4	1.38	15.1	399.91	−0.01	1414.01
112.9	1143.6	294099.1	1.35	14.1	396.05	−0.01	1413.29
113.9	1121.8	294889.5	1.32	13.2	392.36	−0.01	1412.57
114.9	1100.4	295648.6	1.30	12.3	388.80	−0.01	1411.85
115.9	1079.5	296376.4	1.27	11.6	385.39	−0.01	1411.13
116.9	1059.2	297073.0	1.25	10.9	382.14	−0.01	1410.42
117.9	1039.3	297738.3	1.23	10.2	379.02	−0.01	1409.71
118.9	1020.1	298372.3	1.20	9.7	376.06	−0.01	1409.00
119.9	1001.4	298975.0	1.18	9.2	373.23	−0.01	1408.29
120.9	983.4	299546.5	1.16	8.7	370.62	−0.01	1407.58
121.9	966.1	300086.7	1.14	8.2	369.24	−0.01	1406.88
122.9	949.5	300595.6	1.12	7.8	367.93	−0.01	1406.17
123.9	933.6	301073.3	1.10	7.4	366.70	−0.01	1405.47
124.9	918.5	301519.7	1.08	7.0	365.55	−0.01	1404.77
125.9	904.3	301934.8	1.06	6.7	364.48	−0.01	1404.07
126.9	890.9	302318.7	1.04	6.4	363.49	−0.01	1403.37
127.9	878.5	302671.3	1.03	6.2	362.60	−0.01	1402.67
128.9	867.0	302992.7	1.01	6.0	361.77	−0.01	1401.98
129.9	856.4	303282.7	1.00	5.8	361.02	−0.01	1401.29
130.9	846.9	303541.6	0.99	5.6	360.35	−0.01	1400.59
131.9	838.5	303769.2	0.98	5.5	359.77	−0.01	1399.90
132.9	831.1	303965.5	0.97	5.3	359.26	−0.01	1399.21
133.9	824.9	304130.5	0.96	5.2	358.84	−0.01	1398.53
134.9	819.8	304264.3	0.95	5.2	358.50	−0.01	1397.84
135.9	815.9	304366.9	0.95	5.1	358.23	−0.01	1397.16
136.9	813.2	304438.2	0.94	5.1	358.06	−0.01	1396.47
137.9	811.6	304478.2	0.94	5.0	357.95	−0.01	1395.79
138.9	811.3	304487.0	0.94	5.0	357.93	−0.01	1395.11
139.9	812.2	304464.5	0.94	5.0	357.99	−0.01	1394.43
140.9	814.2	304410.8	0.95	5.1	358.12	−0.01	1393.75
141.9	817.5	304325.8	0.95	5.1	358.34	−0.01	1393.07

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CASE 5

X = 0.9518 FT

TIME	VEL	ALT	M	RN	T(R)	Q (BTU/	T(W)
(SEC)	(FT/SEC)	(FT)			(DEG R)	FT2-SEC)	(DEG R)
0.	0.1	-0.	0.00	607.1	518.69	0.00	505.00
0.1	231.3	11.3	0.21	1403866.0	522.65	0.19	505.00
0.2	470.0	45.7	0.42	2850338.6	535.06	0.57	505.04
0.3	716.7	104.0	0.64	4340504.2	556.76	1.37	505.14
0.4	971.4	186.9	0.87	5871556.6	588.63	2.82	505.37
0.5	1234.4	295.3	1.11	7442210.4	631.66	5.19	505.80
0.6	1506.0	429.9	1.35	9050917.4	686.87	8.61	506.55
0.7	1786.3	591.6	1.60	10694594.7	755.35	13.50	507.77
0.8	2075.6	781.3	1.86	12371043.7	838.28	20.12	509.62
0.9	2374.0	999.9	2.13	14076547.9	936.86	28.77	512.31
1.0	2681.8	1248.2	2.41	15808292.0	1052.42	39.82	516.10
1.1	2999.2	1527.3	2.70	17562421.5	1186.35	53.63	521.27
1.2	3326.3	1838.0	3.00	19334275.0	1340.07	70.56	528.14
1.3	3663.4	2181.3	3.30	21119939.7	1515.16	91.02	537.08
1.4	4010.7	2558.2	3.62	22914577.2	1713.26	115.43	548.51
1.5	4368.3	2969.8	3.95	24712371.2	1936.00	144.17	562.90
1.6	4736.6	3417.0	4.29	26508988.2	2185.34	177.70	580.74
1.7	5115.7	3900.9	4.64	28297942.7	2463.10	216.42	602.59
1.8	5506.0	4422.6	5.01	30074076.5	2771.46	260.77	629.06
1.9	5744.8	4752.8	5.23	31127399.7	2971.33	288.59	659.84
1.9	5744.8	4752.8	5.23	31127399.7	2971.33	288.59	659.84
2.9	5427.1	10233.8	5.04	25659366.5	2686.20	182.51	917.41
3.9	5176.1	15436.1	4.90	21385736.7	2468.52	119.30	1082.71
4.9	4973.3	20415.6	4.80	17962645.7	2296.77	79.93	1191.81
5.9	4806.5	25213.4	4.73	15168380.7	2157.63	54.58	1265.42
6.9	4667.3	29860.5	4.69	12853510.7	2042.42	37.70	1315.73
7.9	4549.5	34380.6	4.66	10913128.7	1945.11	26.16	1350.33
8.9	4448.9	38792.7	4.59	8894333.5	1871.07	18.26	1374.16
9.9	4363.3	43112.5	4.50	7093469.9	1814.63	13.00	1390.69
10.9	4289.1	47352.9	4.43	5692194.2	1766.59	9.37	1402.35
11.9	4223.7	51523.9	4.36	4591490.9	1724.92	6.81	1410.57
12.9	4165.2	55633.0	4.30	3720175.7	1688.20	4.98	1416.36
13.9	4112.0	59686.2	4.25	3025807.8	1655.25	3.64	1420.39
14.9	4063.0	63688.1	4.19	2469406.5	1625.28	2.67	1423.15
15.9	4017.4	67642.4	4.15	2021470.0	1597.70	1.94	1424.95
16.9	3974.5	71552.2	4.10	1659337.6	1572.05	1.40	1426.06
17.9	3933.7	75419.6	4.06	1365502.3	1547.90	1.00	1426.65
18.9	3894.7	79246.8	4.02	1126332.4	1525.06	0.69	1426.84
19.9	3857.1	83035.1	3.98	926370.6	1504.37	0.13	1426.60
20.9	3820.8	86785.8	3.91	747918.6	1489.64	0.10	1425.91
21.9	3785.4	90500.0	3.84	607018.1	1475.56	0.07	1425.29
22.9	3750.7	94178.6	3.78	495115.0	1461.99	0.05	1424.62
23.9	3716.8	97822.3	3.72	405780.5	1448.99	0.03	1423.93
24.9	3683.3	101431.4	3.66	334068.4	1436.32	0.01	1423.22
25.9	3650.3	105006.7	3.60	276228.7	1424.04	0.00	1422.50
26.9	3617.6	108548.3	3.55	229353.4	1412.02	-0.01	1421.77
27.9	3585.2	112056.6	3.49	191195.7	1400.28	-0.02	1421.03
28.9	3553.0	115531.8	3.44	159998.8	1388.73	-0.02	1420.28
29.9	3521.1	118974.2	3.39	134392.7	1377.45	-0.03	1419.53
30.9	3489.3	122383.8	3.33	113287.4	1366.32	-0.03	1418.77
31.9	3457.7	125761.0	3.28	95827.8	1355.38	-0.04	1418.01
32.9	3426.2	129105.7	3.24	81330.0	1344.59	-0.04	1417.25
33.9	3394.8	132418.0	3.19	69249.3	1333.95	-0.04	1416.49
34.9	3363.6	135698.2	3.14	59149.5	1323.50	-0.05	1415.72
35.9	3332.4	138946.2	3.09	50675.3	1313.15	-0.05	1414.96
36.9	3301.3	142162.1	3.05	43543.7	1302.93	-0.05	1414.19
37.9	3270.2	145345.9	3.00	37522.2	1292.81	-0.05	1413.43
38.9	3239.3	148497.8	2.96	32424.7	1282.87	-0.05	1412.66

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39.9	3208.3	151617.7	2.92	28094.2	1272.98	-0.05	1411.90
40.9	3177.5	154705.7	2.88	24407.2	1263.27	-0.05	1411.14
41.9	3146.7	157761.9	2.84	21551.3	1249.73	-0.05	1410.38
42.9	3115.9	160786.2	2.82	19122.5	1235.30	-0.05	1409.62
43.9	3085.2	163778.7	2.79	16986.4	1221.05	-0.05	1408.86
44.9	3054.6	166739.4	2.76	15105.8	1206.99	-0.05	1408.10
45.9	3024.0	169668.3	2.73	13448.0	1193.08	-0.05	1407.34
46.9	2993.4	172565.4	2.71	11985.0	1179.30	-0.05	1406.58
47.9	2962.9	175430.9	2.68	10700.9	1165.50	-0.05	1405.83
48.9	2932.4	178264.6	2.67	9791.4	1145.16	-0.06	1405.07
49.9	2901.9	181066.7	2.66	8956.3	1125.05	-0.06	1404.32
50.9	2871.5	183837.0	2.65	8190.3	1105.19	-0.06	1403.57
51.9	2841.2	186575.7	2.64	7487.7	1085.60	-0.06	1402.81
52.9	2810.9	189282.7	2.63	6843.4	1066.22	-0.06	1402.06
53.9	2780.6	191958.1	2.62	6252.6	1047.05	-0.06	1401.31
54.9	2750.4	194601.9	2.61	5711.4	1028.15	-0.06	1400.57
55.9	2720.2	197214.0	2.60	5215.6	1009.45	-0.06	1399.82
56.9	2690.0	199794.6	2.59	4761.5	990.98	-0.05	1399.08
57.9	2659.9	202343.6	2.58	4346.0	972.75	-0.05	1398.34
58.9	2629.9	204860.9	2.56	3965.9	954.78	-0.05	1397.60
59.9	2599.9	207346.7	2.55	3618.1	937.02	-0.05	1396.86
60.9	2569.9	209801.0	2.54	3299.9	919.48	-0.05	1396.13
61.9	2540.0	212223.6	2.53	3009.2	902.18	-0.05	1395.40
62.9	2510.1	214614.8	2.52	2743.5	885.10	-0.05	1394.67
63.9	2480.3	216974.4	2.50	2500.8	868.27	-0.05	1393.95
64.9	2450.5	219302.5	2.49	2279.2	851.64	-0.05	1393.22
65.9	2420.8	221599.0	2.48	2076.8	835.26	-0.04	1392.51
66.9	2391.1	223864.1	2.46	1892.1	819.09	-0.04	1391.79
67.9	2361.5	226097.6	2.45	1723.6	803.17	-0.04	1391.08
68.9	2332.0	228299.7	2.44	1570.0	787.49	-0.04	1390.36
69.9	2302.5	230470.2	2.42	1429.8	772.02	-0.04	1389.66
70.9	2273.1	232609.3	2.41	1302.0	756.78	-0.04	1388.95
71.9	2243.7	234716.9	2.39	1185.6	741.76	-0.03	1388.25
72.9	2214.4	236793.1	2.38	1079.5	726.97	-0.03	1387.55
73.9	2185.1	238837.7	2.36	982.8	712.39	-0.03	1386.86
74.9	2156.0	240851.0	2.35	894.8	698.08	-0.03	1386.16
75.9	2126.9	242832.7	2.33	814.6	683.97	-0.03	1385.47
76.9	2097.8	244783.1	2.32	741.6	670.07	-0.03	1384.79
77.9	2068.9	246702.0	2.30	675.2	656.43	-0.03	1384.10
78.9	2040.0	248589.5	2.28	614.8	642.99	-0.03	1383.42
79.9	2011.2	250445.5	2.27	559.8	629.79	-0.03	1382.74
80.9	1982.5	252270.2	2.25	509.8	616.81	-0.02	1382.06
81.9	1953.9	254063.4	2.23	464.3	604.07	-0.02	1381.39
82.9	1925.4	255825.2	2.21	422.9	591.55	-0.02	1380.71
83.9	1897.0	257555.6	2.20	385.3	579.26	-0.02	1380.04
84.9	1868.6	259254.6	2.18	351.1	567.16	-0.02	1379.38
85.9	1840.4	260922.3	2.16	320.0	555.32	-0.02	1378.71
86.9	1812.3	262558.5	2.14	291.3	543.96	-0.02	1378.05
87.9	1784.3	264163.4	2.11	259.9	536.43	-0.02	1377.39
88.9	1756.4	265736.9	2.07	232.3	529.03	-0.02	1376.73
89.9	1728.6	267279.0	2.04	208.0	521.78	-0.02	1376.07
90.9	1701.0	268789.8	2.01	186.6	514.70	-0.02	1375.42
91.9	1673.5	270269.2	1.98	167.7	507.76	-0.01	1374.76
92.9	1646.2	271717.2	1.94	151.0	500.98	-0.01	1374.11
93.9	1618.9	273133.9	1.91	136.1	494.31	-0.01	1373.47
94.9	1591.9	274519.2	1.88	123.0	487.82	-0.01	1372.82
95.9	1565.0	275873.2	1.85	111.3	481.46	-0.01	1372.17
96.9	1538.3	277195.9	1.82	100.9	475.26	-0.01	1371.53
97.9	1511.8	278487.2	1.79	91.6	469.22	-0.01	1370.89
98.9	1485.4	279747.2	1.75	83.3	463.29	-0.01	1370.25
99.9	1459.3	280975.8	1.72	75.9	457.54	-0.01	1369.61
100.9	1433.4	282173.2	1.69	69.3	451.94	-0.01	1368.98
101.9	1407.6	283339.2	1.66	63.4	446.45	-0.01	1368.34
102.9	1382.2	284473.9	1.63	58.0	441.15	-0.01	1367.71
103.9	1356.9	285577.3	1.60	53.3	435.96	-0.01	1367.08
104.9	1332.0	286649.3	1.57	49.0	430.95	-0.01	1366.45

105.9	1307.3	287890.1	.54	45.1	426.08	-0.01	1365.82
106.9	1282.9	288699.6	1.51	41.6	421.35	-0.01	1365.19
107.9	1258.8	289677.7	1.49	38.5	416.76	-0.01	1364.56
108.9	1235.0	290624.6	1.46	35.6	412.32	-0.01	1363.94
109.9	1211.6	291540.1	1.43	33.0	408.04	-0.01	1363.32
110.9	1188.6	292424.4	1.40	30.7	403.91	-0.01	1362.70
111.9	1165.9	293277.4	1.38	28.6	399.91	-0.01	1362.07
112.9	1143.6	294099.1	1.35	26.7	396.05	-0.01	1361.46
113.9	1121.8	294889.5	1.32	24.9	392.36	-0.01	1360.84
114.9	1100.4	295648.6	1.30	23.3	388.80	-0.01	1360.22
115.9	1079.5	296376.4	1.27	21.9	385.39	-0.01	1359.61
116.9	1059.2	297073.0	1.25	20.6	382.14	-0.01	1358.99
117.9	1039.3	297738.3	1.23	19.4	379.02	-0.01	1358.38
118.9	1020.1	298372.3	1.20	18.3	376.06	-0.01	1357.77
119.9	1001.4	298975.0	1.18	17.3	373.23	-0.01	1357.16
120.9	983.4	299546.5	1.16	16.4	370.62	-0.01	1356.55
121.9	966.1	300086.7	1.14	15.5	369.24	-0.01	1355.95
122.9	949.5	300595.6	1.12	14.7	367.93	-0.01	1355.34
123.9	933.6	301073.3	1.10	14.0	366.70	-0.00	1354.73
124.9	918.5	301519.7	1.08	13.3	365.55	-0.00	1354.13
125.9	904.3	301934.8	1.06	12.7	364.48	-0.00	1353.53
126.9	890.9	302318.7	1.04	12.2	363.49	-0.00	1352.93
127.9	878.5	302671.3	1.03	11.7	362.60	-0.00	1352.33
128.9	867.0	302992.7	1.01	11.3	361.77	-0.00	1351.73
129.9	856.4	303282.7	1.00	10.9	361.02	-0.00	1351.13
130.9	846.9	303541.6	0.99	10.6	360.35	-0.00	1350.53
131.9	838.5	303769.2	0.98	10.4	359.77	-0.00	1349.94
132.9	831.1	303965.5	0.97	10.1	359.26	-0.00	1349.34
133.9	824.9	304130.5	0.96	9.9	358.84	-0.00	1348.75
134.9	819.8	304264.3	0.95	9.8	358.50	-0.00	1348.16
135.9	815.9	304366.9	0.95	9.7	358.23	-0.00	1347.56
136.9	813.2	304438.2	0.94	9.6	358.06	-0.00	1346.97
137.9	811.6	304478.2	0.94	9.5	357.95	-0.00	1346.38
138.9	811.3	304487.0	0.94	9.5	357.93	-0.00	1345.80
139.9	812.2	304464.5	0.94	9.6	357.99	-0.00	1345.21
140.9	814.2	304410.8	0.95	9.6	358.12	-0.00	1344.62
141.9	817.5	304325.8	0.95	9.7	358.34	-0.00	1344.04

HASP

ALL DIMENSIONS IN INCHES
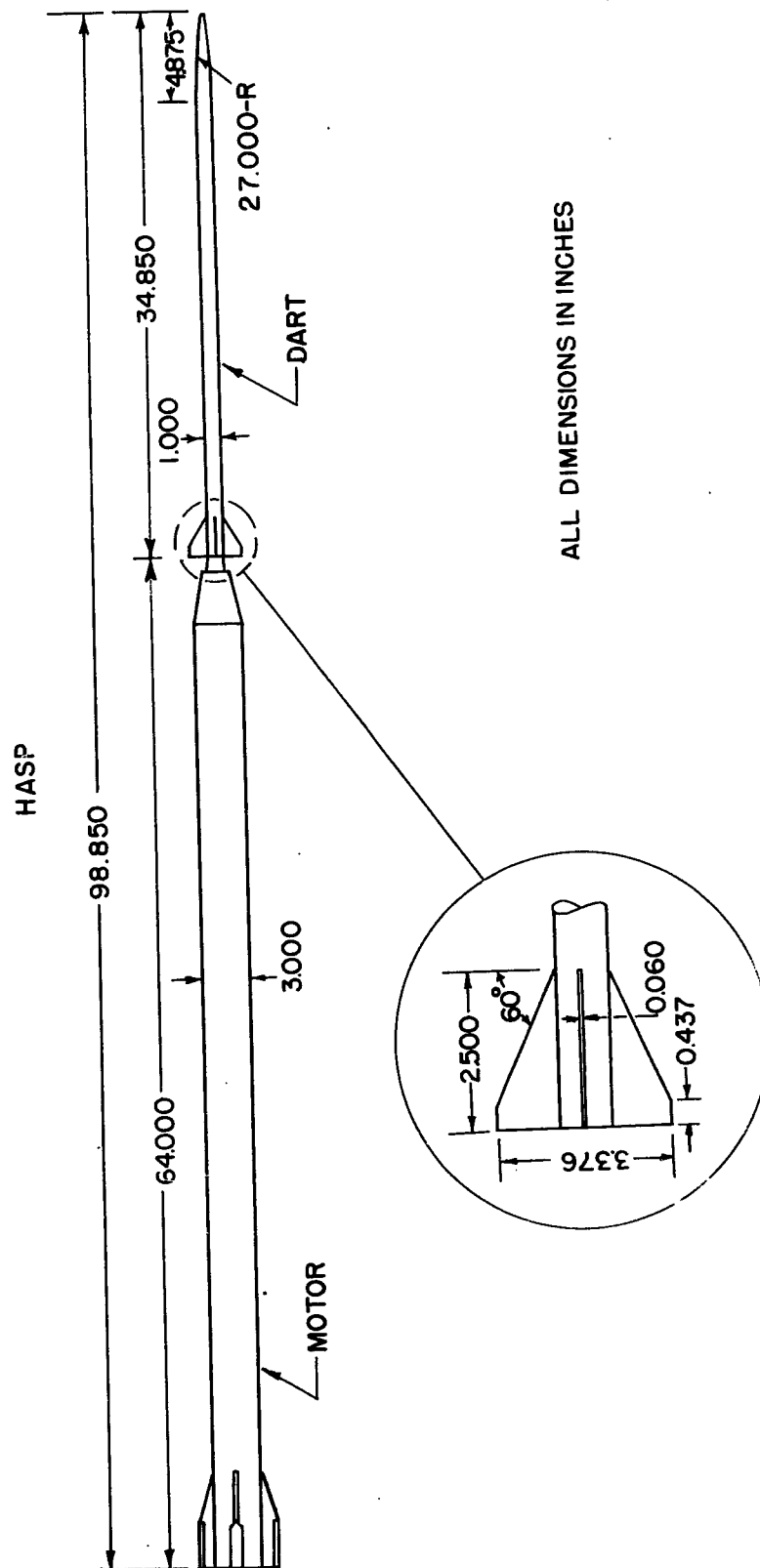
FIG. 1 DART-BOOSTER ASSEMBLY DRAWING
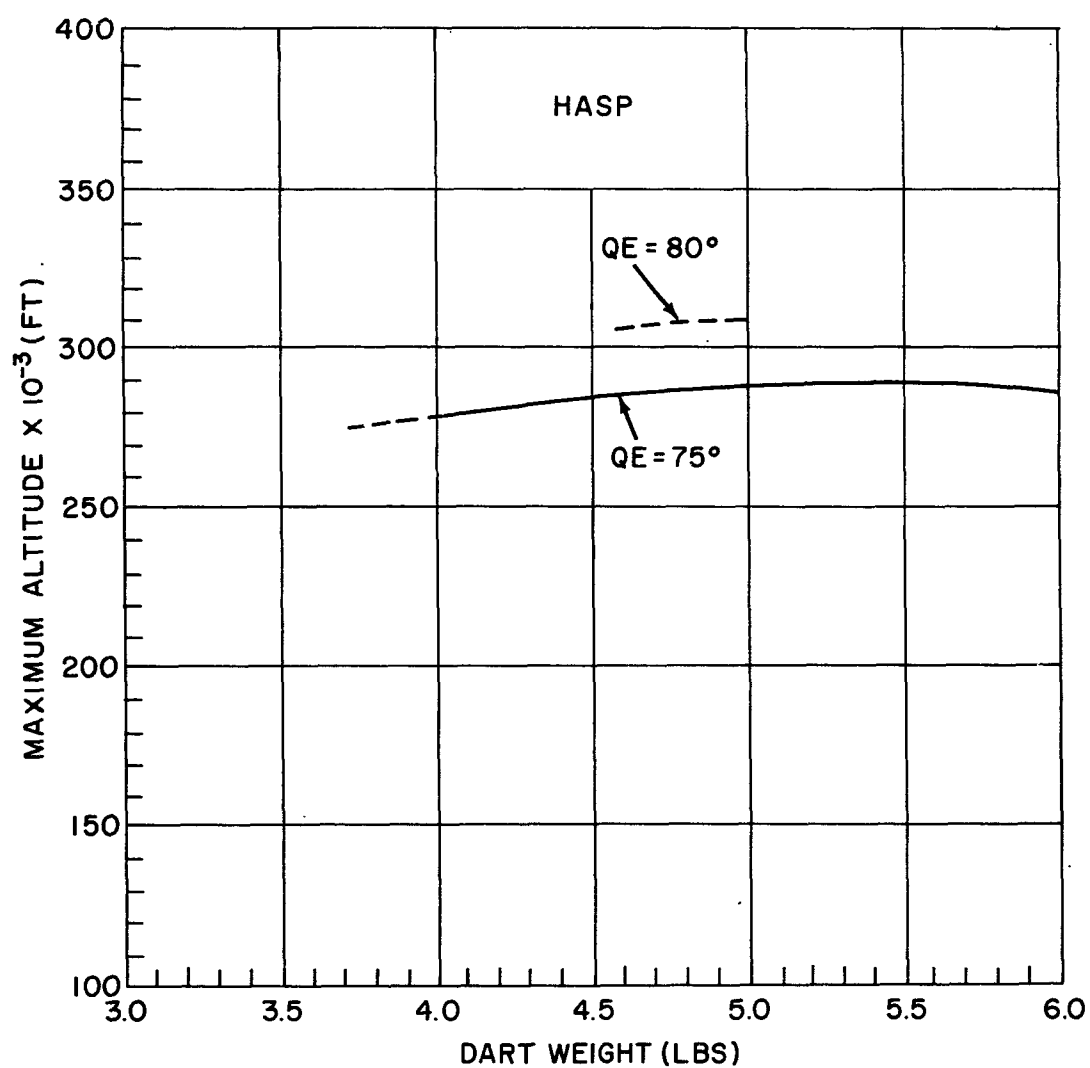
FIG. 2 MAXIMUM ALTITUDES FOR THE 1.0-INCH DART
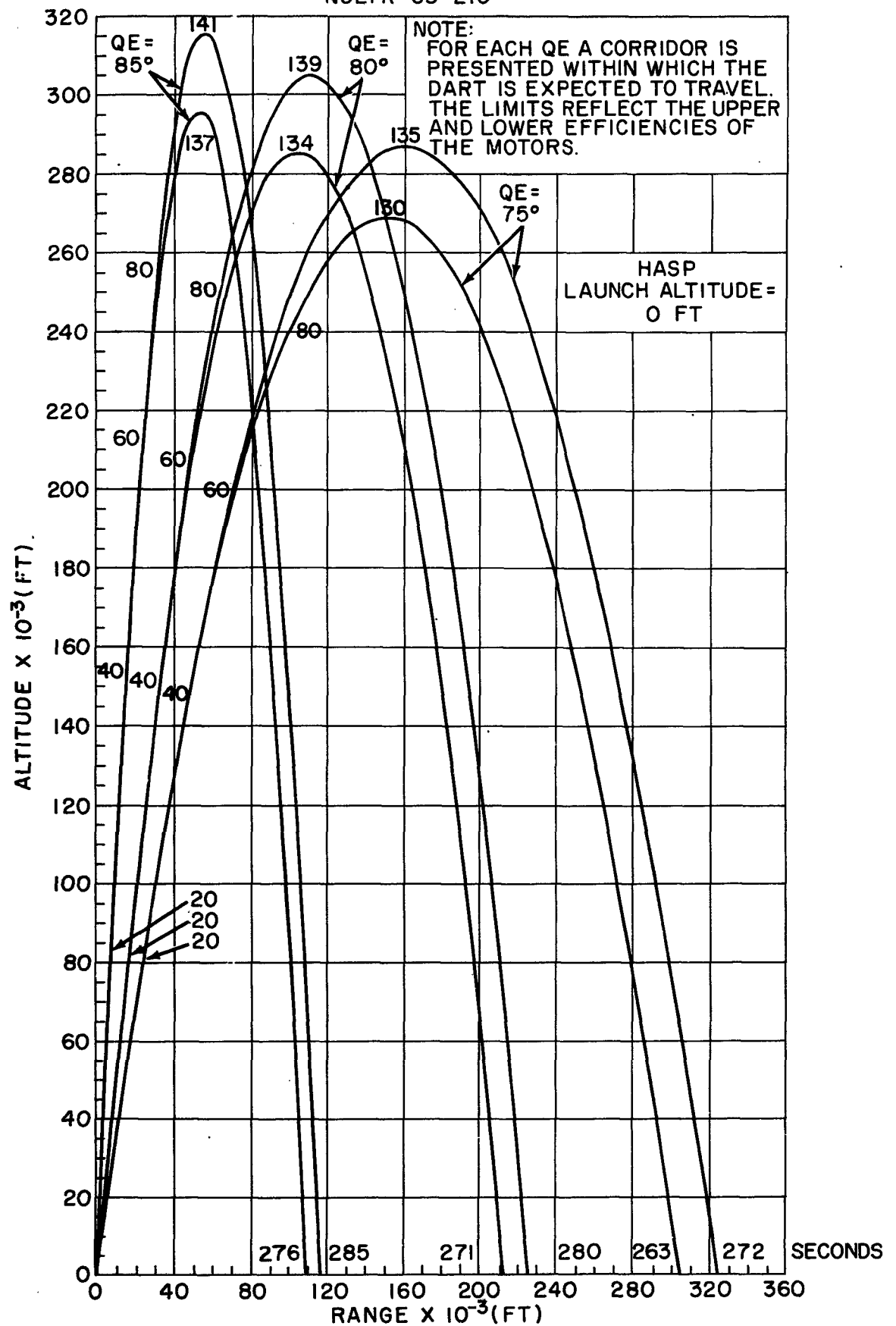
FIG. 3 TRAJECTORIES FOR THE 1.0-INCH, 5.0 LB DART
FOR THE MK 32 MOD O MOTOR
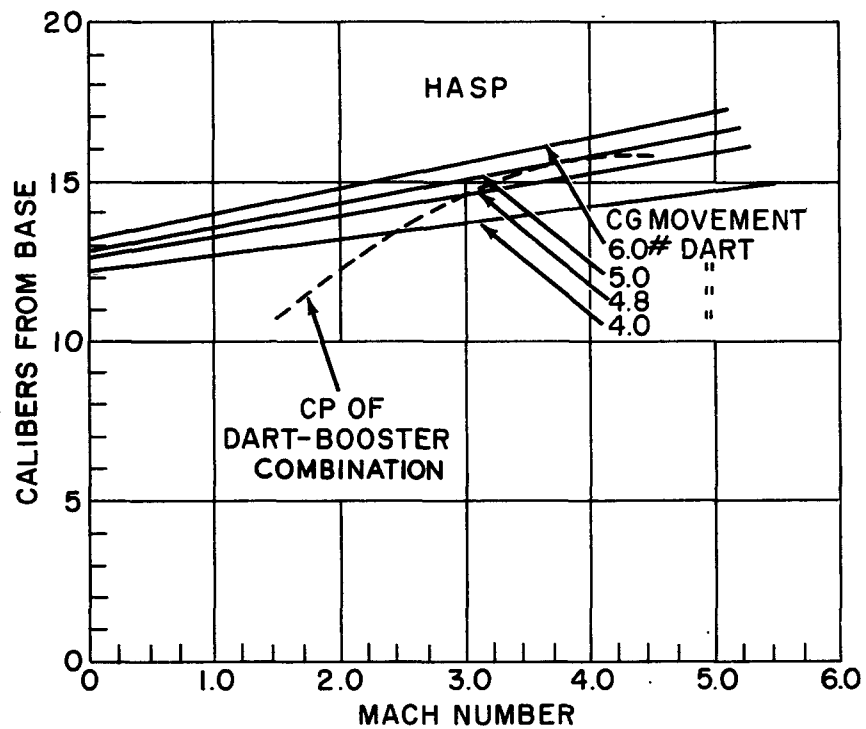
FIG. 4 STATIC STABILITY MARGIN OF 1.0-INCH DART-BOOSTER
COMBINATION
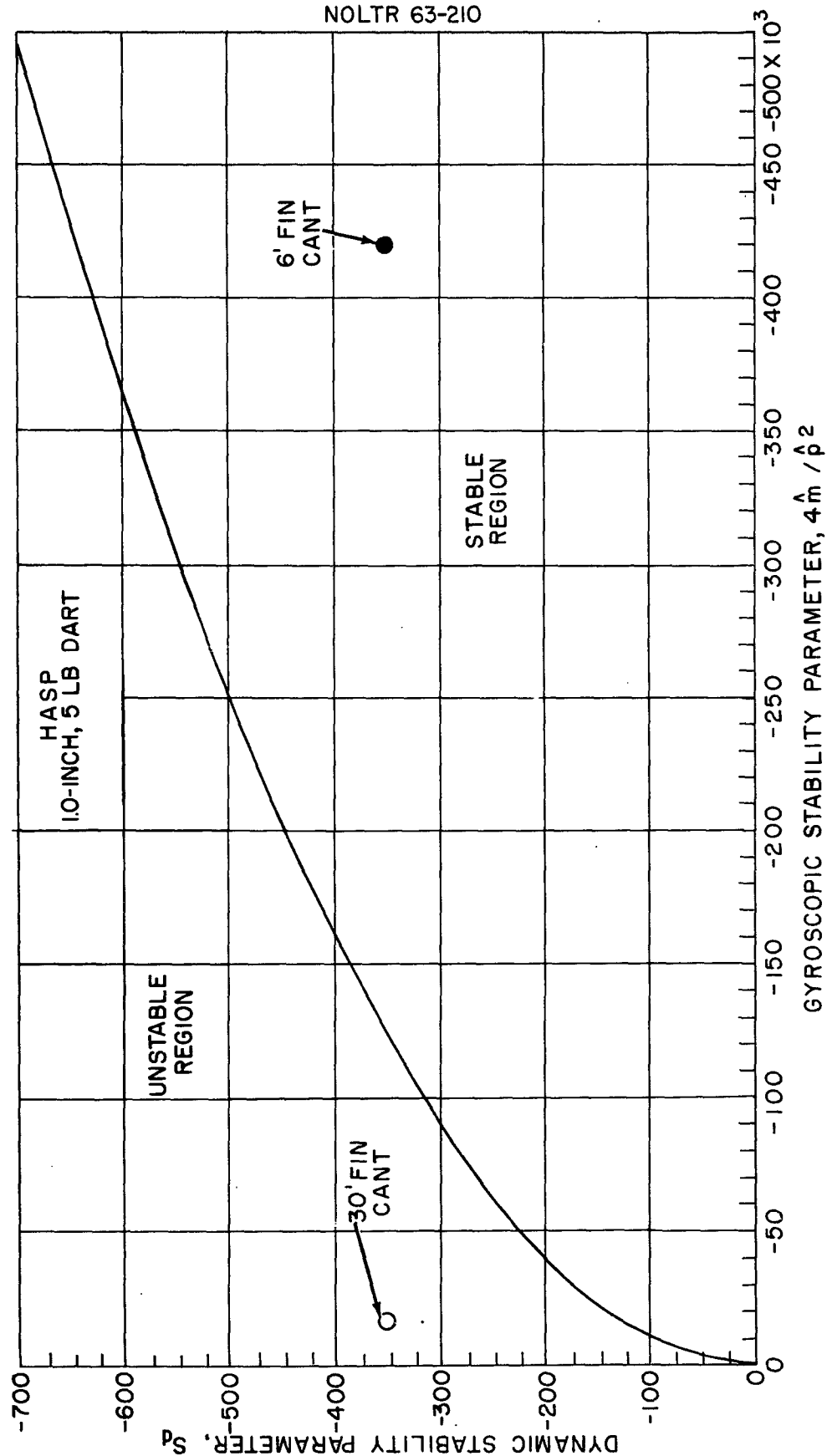
FIG. 5 DYNAMIC STABILITY CHARACTERISTICS
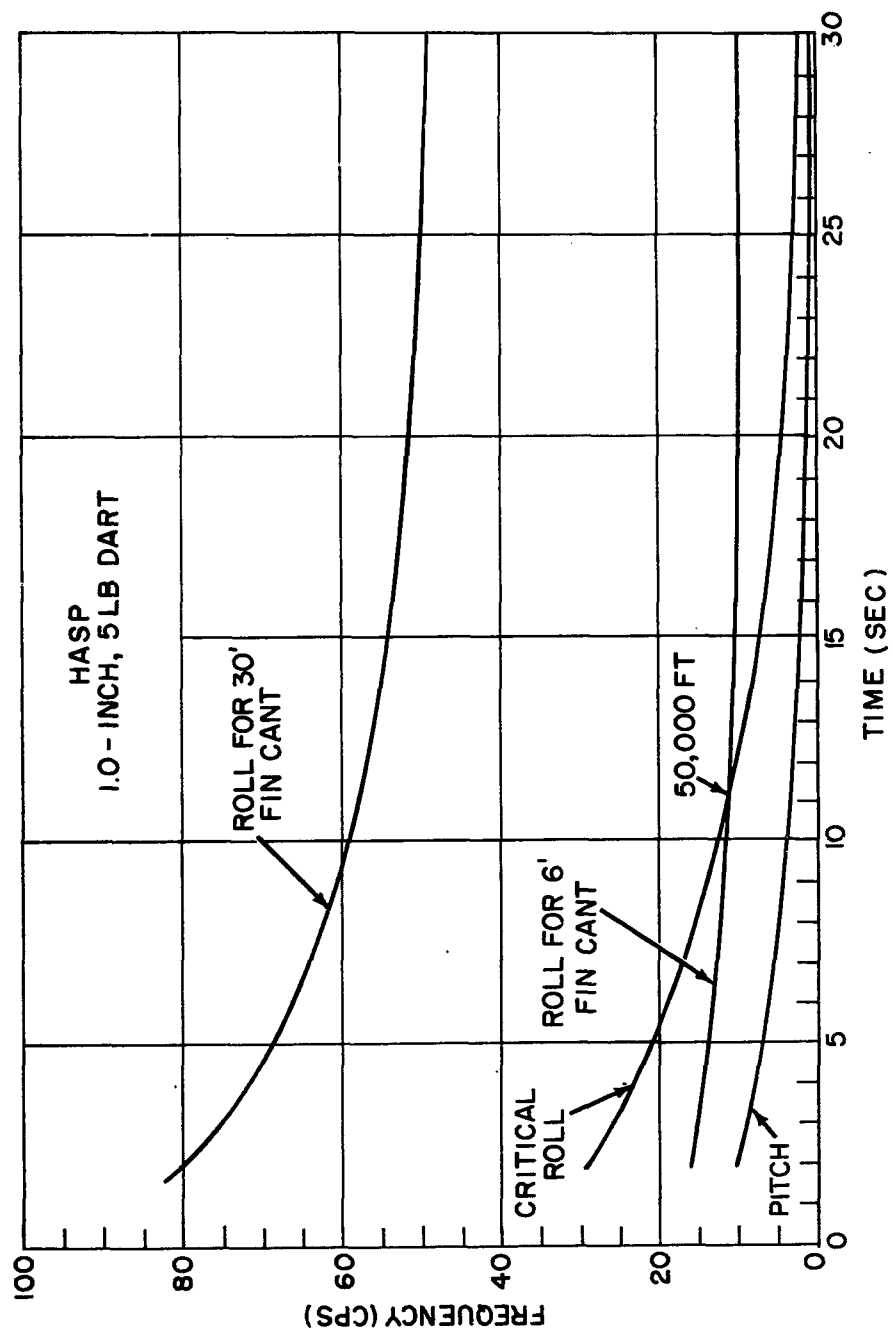
FIG. 6 PITCH AND ROLL CHARACTERISTICS
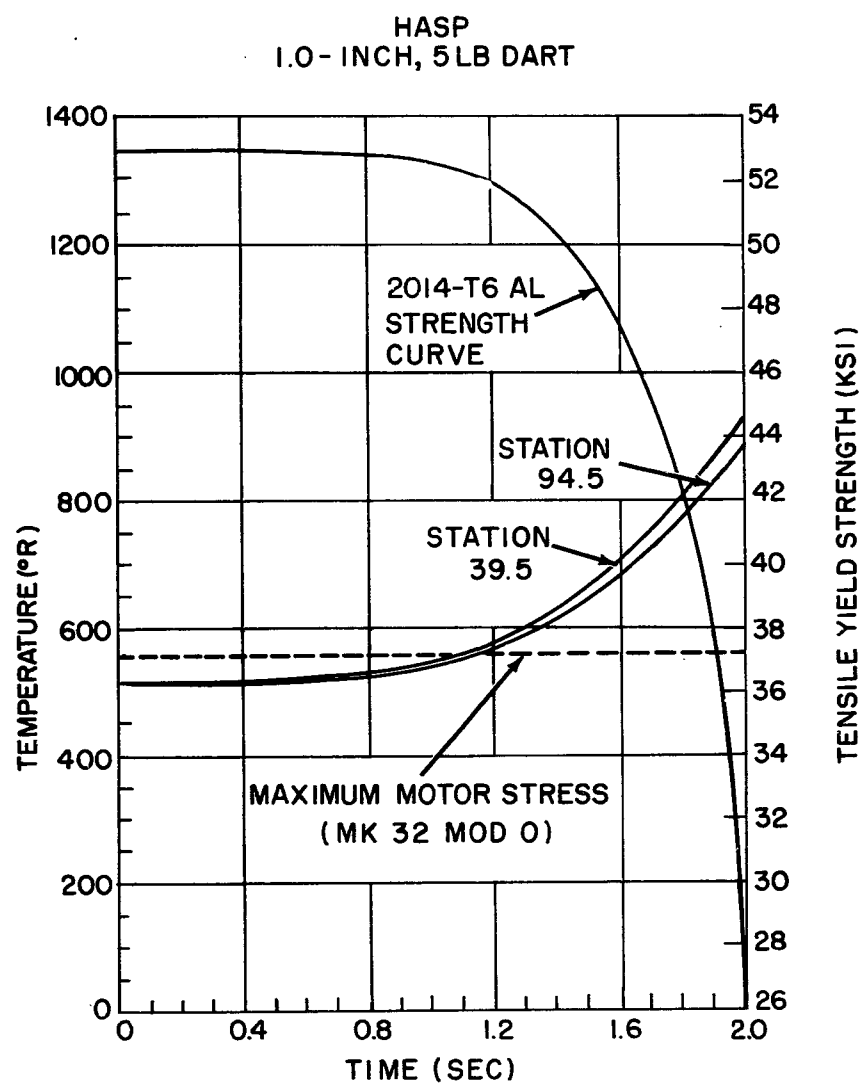
FIG. 7 MOTOR WALL TEMPERATURE AND STRESS AS A
FUNCTION OF TIME
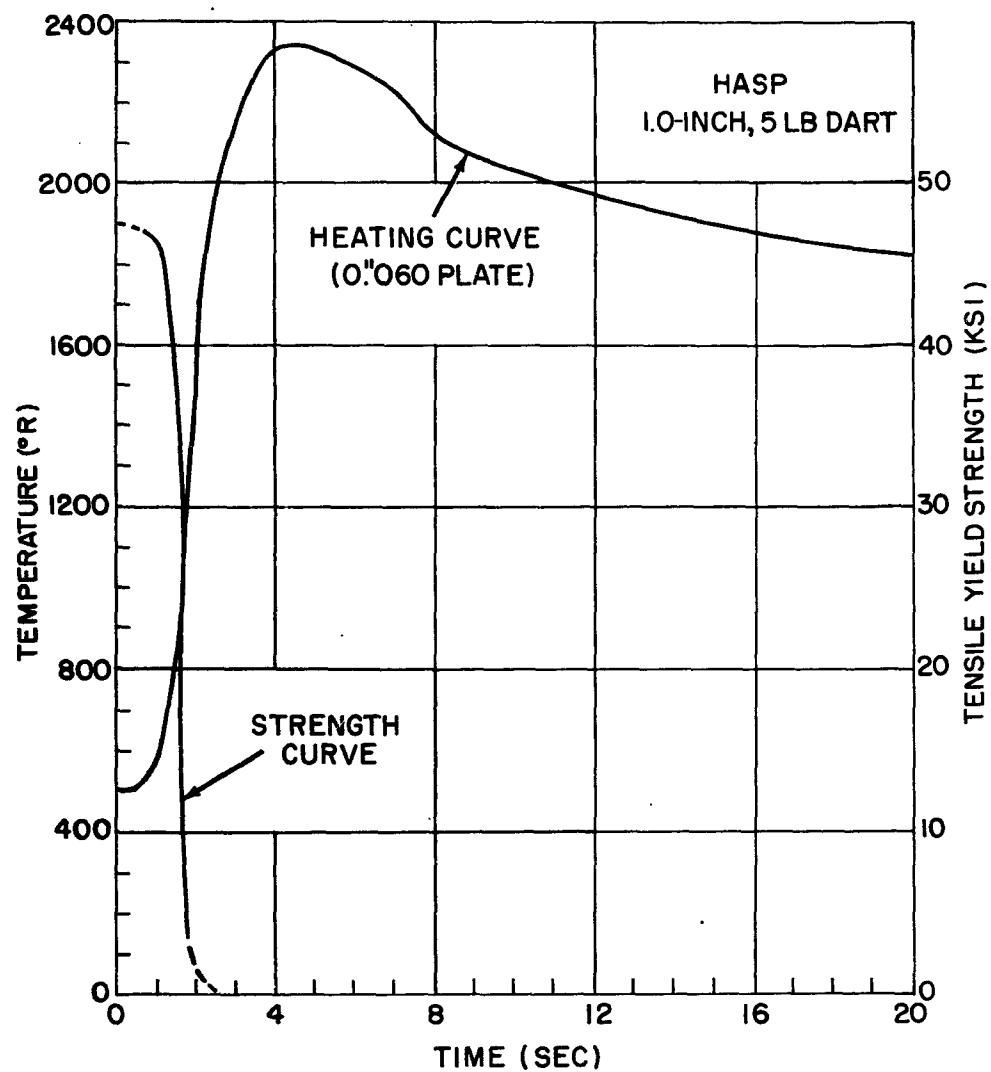
FIG. 8 ALUMINUM 2024-T4 FIN TEMPERATURES AND
STRENGTH AS A FUNCTION OF TIME
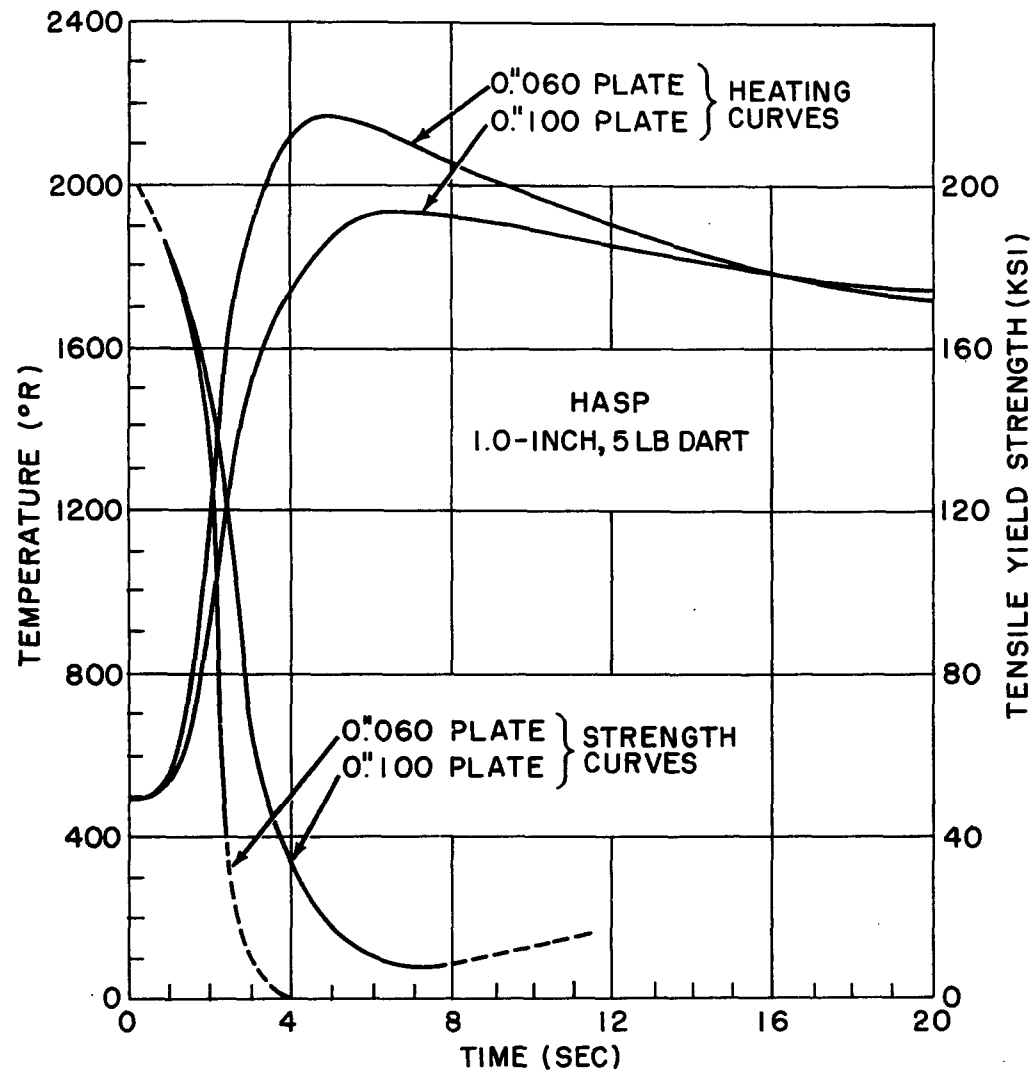
FIG. 9 STAINLESS STEEL FIN TEMPERATURES AND STRENGTH
AS A FUNCTION OF TIME

HASP
1.0 - INCH, 5 LB DART
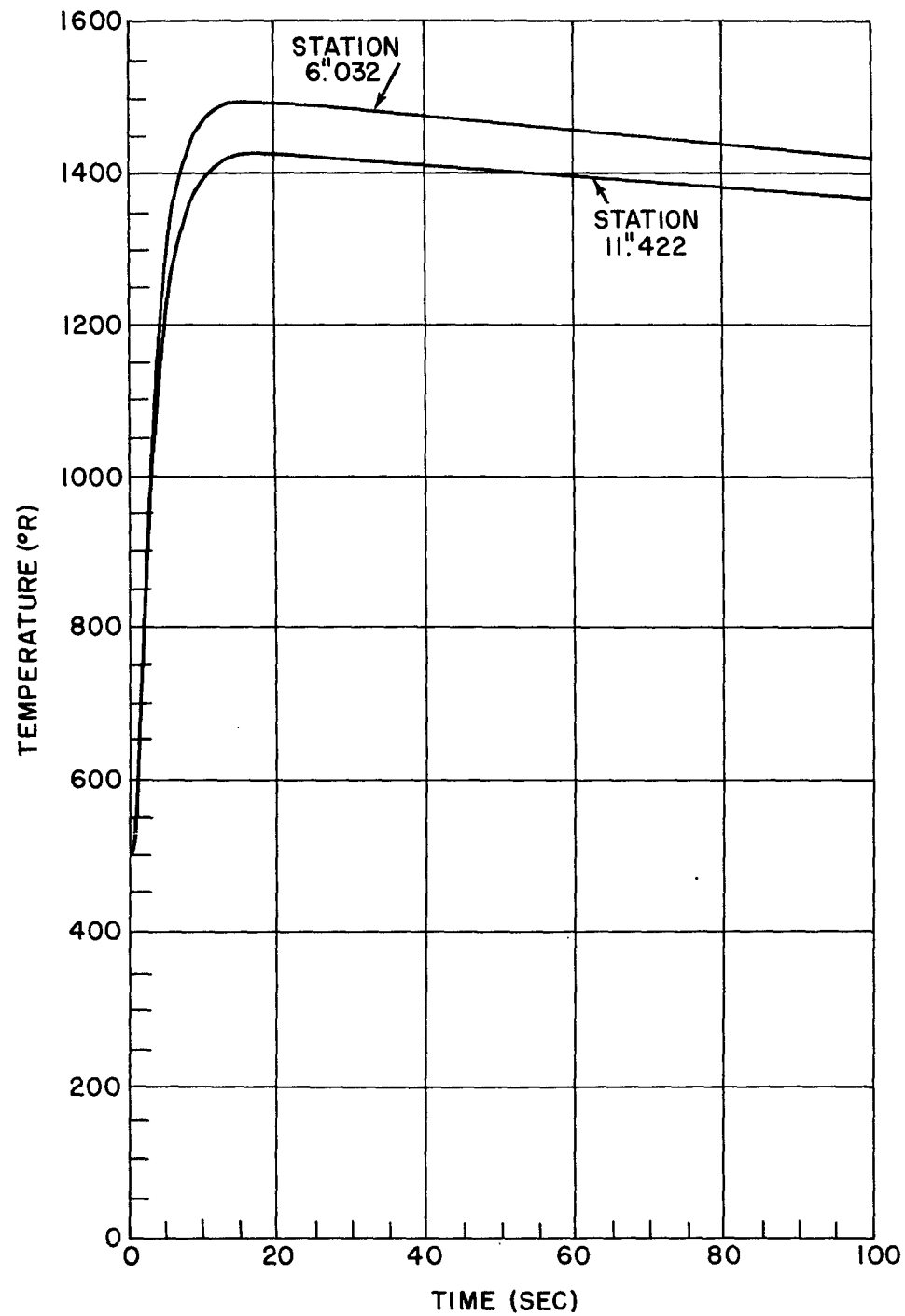
FIG.10   NOSE CONE TEMPERATURE AS A FUNCTION OF TIME

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AERODYNAMIC AND AEROTHERMODYNAMIC STUDIES OF
THE HASP 1.0-INCH DIAMETER DART (U), by H. J.
Gauzza. 30 Apr. 1964. 20p. illus., tables.
(Aerodynamics research report 208) BuWeps
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The NOL high altitude sounding projectile
(HASP) is the subject of a design study aimed
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niques and results of this study are de-
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